NON-PROPRIETARY

Enclosure 3 – RAI Response

RAI Letter Dated March 9, 2016

NRC QUESTION 1:

1. Please docket the documents identified below:
   - FA10-0501-0024, Software Program Plan
   - NICSD Verification and Validation Plan
   - P-101, NICSD Manufacture of FPGA-based equipment
   - FPG-PLN-A70-0001, Project Quality Assurance Plan
   - FPG-PLN-C51-0003, NRW-FPGA-based PRM System Qualification Project Quality Assurance Plan

RESPONSE:

Toshiba will docket above requested documents by April 8, 2016 except P-101. P-101 is a Toshiba internal document. NRC can see P-101 during the audit.

NRC QUESTION 2:

Equipment Qualification

2. (Open Item 39) The Power Range Monitoring (PRM) System Qualification Test Summary (FPG-TRT-C51-0101) does not identify the same local power range monitoring (LPRM) and analog output (AO) modules that were listed in other equipment qualification (EQ) tests. Clarify if the same LPRM and AO modules were used for all EQ tests. Also, please clarify if the same LPRM and AO modules with additional capacitors were used for all EQ tests.

RESPONSE:

The PRM System Qualification Test Summary Report (FPG-TRT-C51-0101) describes that the LPRM and AO modules used for EMC test were not the same as the modules used for other EQ tests. The new LPRM and AO modules had additional capacitors to enhance electric-noise-withstand-capability.

Toshiba identified a concern regarding the appropriateness of the EMC testing prior to the test performance in an internal review.

Two capacitors were added on the LPRM module. Those two capacitors are the same capacitors used in the other locations in the LPRM module.

Several changes were made to the multiple output channels on the AO board. The changes can be grouped into four categories as follows:

(1) Toshiba added [ ]^{a,c} capacitors of the same type and capacity used in the LPRM module.
(2) Toshiba added [ ]^{a,c} capacitors that are of the same type as those used in the LPRM module but have a different capacity.
(3) Toshiba replaced [ ]^{a,c} capacitors with the same capacitor described in Item (2).
(4) Toshiba added [ ]^{a,c} capacitors of the same type and capacity that were originally used in the same AO module in different locations.

Because the same types of capacitors as the added capacitors had been used in other modules that passed the EQ tests (the environmental test and seismic test), Toshiba considered that the results of the environmental test and seismic test for the LPRM and AO modules without the additional capacitors were applicable to the LPRM and AO modules with the additional capacitors. Toshiba repeated the electromagnetic qualification tests with the revised modules.

NRC QUESTION 3:

Equipment Qualification

3. (Open Item 40) There are some discrepancies related to the applicant's document quality control, which were found in the applicant's documents. Please clarify these inconsistencies:

   a. The PRM System Qualification Test Summary (FPG-DRT-C51-0101, Rev. 0), Figure 5-1, "Actual Test Flow Diagram," does not match Figure 4-1, "Master Test Plan Flow Diagram," in the Master Test Plan (FPG-PLN-C51-0005, Rev. 3).
   b. The cover page of the Qualification Test Summary Report identifies as document number "FPG-TRT-C51-0101." However, the pages inside (at the top of the page), identify this document as "FPG-DRT-C51-0101."
   c. The Master Test Plan (FPG-PLN-C51-0005, Rev. 3) does not identify the achievable amplitudes for both Operation Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) seismic events.
   d. The PRM System Qualification Test Summary (FPG-DRT-C51-0101, Rev. 0), page 25, references Table 4-1 and Figure 4-5, but these references were not included in the document.

RESPONSE:

a. In Figure 5-1 of the Qualification Test Summary Report (FPG-TRT-C51-0101 Rev.0), the new activities: "Modification of the modules to enhance the noise withstand capability" and "Re-install the original modules to confirm the aging effects during environmental testing" were added to Figure 4-1 of the Master Test Plan (FPG-PLN-C51-0005 Rev.3). The change relates to NRC Question 2. Toshiba will revise Figure 4-1 of the Master Test Plan, to be consistent with the correct data presented in Figure 5-1 of the Qualification Test Summary Report.

b. Toshiba confirmed that the correct document number is FPG-TRT-C51-0101. Toshiba will correct the error in a revision of the document.

c. In the table on Page 54 of the Master Test Plan (FPG-PLN-C51-0005 Rev.3), the achievable amplitude of the OBE and the SSE are described as "To be provided." This description was made in intent to require the maximum amplitude that could be achieved by the test equipment in the seismic testing. Toshiba will correct the description in the Master Test Plan in a revision to clarify the intent and incorporated the levels that the testing achieved in this revision, clearly noting that the revision was performed after testing completed.

d. Toshiba confirmed that the correct references are Table 5-1 and Figure 5-1 of the Qualification Test Summary Report, FPG-TRT-C51-0101 Rev.0. Toshiba will correct the errors in the revision of the document.

Note: Toshiba will revise the above mentioned Master Test Plan (FPG-PLN-C51-0005) and Qualification Test Summary Report (FPG-TRT-C51-0101) by April 8, 2016.

NRC QUESTION 4:

Equipment Qualification

4. (Open Item 43) The Environmental Qualification Report for Oscillation Power Range Monitoring (OPRM) unit (FC51-7513-1000) summarizes the test results from EQ testing. This report does not include the results from the 1E to non-Class 1E isolation test.

RESPONSE:

The response to this NRC question is included in the response to NRC Question 5.

NRC QUESTION 5:

Equipment Qualification

5. Please explain why this report does not include Class 1E to non-Class 1E isolation test for the OPRM unit.

RESPONSE:

As described in Section III-5.1.1 of the TR, because fuses, analog isolators, optical couplers, and fiber optic cables which support Class 1E to Non-Class 1E isolation are not included in the scope of the ABWR OPRM qualification, no Class 1E to Non-Class 1E isolation test was performed for the ABWR OPRM.

NRC QUESTION 5a:

Equipment Qualification

5a. (Open Item 44) It is not clear in the applicant's EQ document whether the required burn-in test with a minimum 352 hours was conducted on the assembled test specimen for the OPRM system or not. If not, justifications should be provided.

RESPONSE:

More than 352 hours of burn-in tests were conducted on the assembled test specimen for the OPRM system as a part of the system validation tests. NRC can see the test records during the audit.

NRC QUESTION 6:

Equipment Qualification

6. (Open Item 45) Electric Power Research Institute (EPRI) Topical Report (TR)-1077330, "Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants," requires vendors to perform response time test during EQ testing. The Equipment Design Specification for Power Range Neutron Monitor (FC51-3002-1000, Rev.4) defines the OPRM trip response time requirements. However, the Environmental Qualification Report (FC51-7513-1000) does not include results of such test. Please explain why the response time test was not performed.

RESPONSE:

Response time tests were conducted in the software validation testing. Section 5.1.4 Item 6 A of the EDS (FC51-3002-1000 Rev.4) describes the OPRM trip response time requirements. Section 9 of the Software

Validation Test Plan for Additional Validation (FC51-7012-1004 Rev.0), describes the response time acceptance criteria. As shown in Section 10.3 of the Software Validation Test Report (FC51-7513-1002 Rev.2), the PBDA trip signal met the acceptance criteria. Response time testing had been performed in controlled conditions and none of the equipment qualification test stressors would change that response time appreciably.

NRC QUESTION 7:

Equipment Qualification

7. (Open Items 46 , 61, and 62) Toshiba documents are not consistent when identifying the modules qualified during EQ testing for the PRM system and those identified in the TR for review and approval of the PRM system. Please identify all modules qualified for the PRM system and OPRM unit for which Toshiba is requesting review and approval in its TR. Please include name, model number, and brief description for each module. If references to possible module substitutes and old modules are included in the response, please provide clear explanation and justification of why these modules are referenced.

   For modules listed in the EQ testing documents that are not part of the review scope (e.g., MUX module HNS260) but were necessary for testing, please identify them as out of scope.

RESPONSE:

Table II-A-3-1 of the UTLA-0020P Part II Rev.3 provides the configuration qualified in the BWR-5 PRM qualification and Table II-A-3-2 of the UTLA-0020P Part II Rev.3 provides the configuration qualified in the ABWR OPRM qualification. Table II-2-6 of the UTLA-0020P Part II Rev.3 provides the current configuration for the BWR-5 PRM and ABWR OPRM. Table II-2-6 identifies the qualified modules by shading. The unshaded MUX module, which is used to send the LPRM levels to external equipment, was not qualified. For cases such LPRM levels are required by external equipment, the MUX module is listed in the table. In the current BWR-5 PRM system, the TRN module (HNS0531B00001) and the RCV module (HNS0541B00001) qualified in the ABWR OPRM qualification are used instead of the TRN module (HNS530B00000) and the RCV module (HNS540B00000) qualified in the BWR-5 PRM qualification. The TRN module (HNS0531B00001) and the RCV module (HNS0541B00001) are common for every current unit.

The serial numbers for the modules and the components qualified in the BWR-5 PRM qualification are provided in the MCL for BWR-5 PRM (FPG-CFM-C51-0001 Rev.7) (the final configuration is provided with date Feb 20, 2008). The serial numbers for modules and components qualified in the ABWR OPRM qualification are provided in the MCL for ABWR OPRM (FC51-2504-1000 Rev.16).

a) For the PRM system, the modules identified in the Master Test Plan and the unit design specifications were modified throughout the qualification, and given the new model type numbers. The following table shows the old and the new type numbers of the modules.

Old Module Type	New Module Type
LPRM Module HNS011	LPRM Module HNS013
AO Module HNS511	AO Module HNS515
AO Module HNS512	AO Module HNS516
AO Module HNS513	AO Module HNS517
AO Module HNS514	AO Module HNS518
TRN Module HNS530 or HNS530B00000	TRN Module HNS0531B00001
RCV Module HNS540 or HNS540B00000	RCV Module HNS0541B00001

In the qualification testing of the BWR-5 PRM, LPRM module HNS011, AO modules HNS 511, HNS 512, HNS 513, and HNS 514 were replaced with LPRM module HNS013, AO modules HNS 515, HNS 516, HNS 517, and HNS 518 after August 24, 2007, as shown in the MCL for BWR-5 PRM. The newer modules have additional capacitors that enhance electromagnetic-noise-withstand-capability as described in Section 2.4 of the Qualification Test Summary Report (FPG-TRT-C51-0101 Rev.0) and our response to NRC Question 2 above. Because no FPGA logic was changed in the modification, Toshiba considers the V&V activities and EQ testing for the older modules are applicable to the newer modules and requests those activities to be reviewed. The old modules themselves are out of the scope of the review. Toshiba will not supply the older versions of these modules.

b) Modules qualified in the PRM qualification are listed in Table II-A-3-1 of the TR. The TRN module HNS530B00000 and RCV module HNS540B00000 listed in this table are out of the scope of the review. The newer TRN module HNS0531B00001 and RCV module HNS0541B00001 qualified through the ABWR OPRM qualification testing are applied to the PRM system. The Toshiba response to NRC Question 26 explains why the new qualified TRN and RCV modules can be used in the PRM system.

Appendix II-B of the TR provides a brief description for each module.

NRC QUESTION 8:

Equipment Qualification

8. (Open Item 63) (Note this item is related to Open Items 46 and 61) The Master Configuration List (FPG-CFM-C51-0001), Section 2, lists the Hardware Configuration for the test specimen. This information is presented in table format, which includes a "date" column. Please explain what the purpose of the information provided in the column "date" is referring. In addition, please clearly identify the hardware configuration that corresponds to the test specimen described in Appendix 1 of the Master Test Plan (FPG-PLN-C51, Rev. 3), and for which Toshiba is requesting approval in its TR.

RESPONSE:

As described in Section 2.4 of the Qualification Test Summary Report (FPG-TRT-C51-0101 Rev.0), system configuration was changed during the EMI/RFI, Surge Withstand Capability, EFT/B, ESD and Class 1E to Non-1E Isolation tests of the BWR-5 PRM qualification. The purpose of date column in the

Master Configuration List (FPG-CFM-C51-0001 Rev.7) is to identify the test configurations by the date information.

The module configuration in each unit that was qualified in the BWR-5 PRM qualification testing is shown in Table II-A-3-1 of the TR Part II Rev.3. The Table II-A-3-1 supplements Table A1-1 in Appendix 1 of the Master Test Plan (FPG-PLN-C51-0005, Rev. 3), which does not list the module configuration in each unit.

Toshiba will revise the PRM Qualification Test Summary Report to clarify the MCL issues by April 8, 2016.

NRC QUESTION 9:

Equipment Qualification

9. (Open Item 47) The Qualification Test Summary Report (FPG-TRT-C51-0101) documents the result of environmental qualification test and qualification analysis performed on the PRM system. This document does not identify the standards used to calibrate the test specimen, measuring and test equipment used for the EQ of the PRM system. Clarify what standards were used.

RESPONSE:

The test specimens were tested using test equipment calibrated to sources traceable to the National Metrology Institute of Japan (NMIJ). NMIJ is a signatory to the Bureau International des Poids et Mesures (BIPM), as is the National Institute of Standard and Technology (NIST). Wyle calibrations are traceable to NIST.

NRC QUESTION 10:

Equipment Qualification

10. (Open Item 48) Table 5-1 of the EPRI TR-107330 specifies operability and prudency tests for the test specimen. Please clarify whether these tests were performed for the PRM system during the qualification tests. In addition, Sections 5.3 and 5.4 of the EPRI TR-107330 identify the test requirements for the operability and prudency tests. Please also identify the test requirements included in these tests for the qualification of the PRM system.

RESPONSE:

As described in Figure 5-1 of the Qualification Test Summary Report, (FPG-TRT-C51-0101 Rev.0), the operability test and prudency test were conducted as pre-qualification test and performance proof test. Table 3.15-1 provides what test items specified in Sections 5.3 and 5.4 of EPRI TR-107330 are included for the operability test and prudency test in the qualification of the PRM system.

NRC QUESTION 11:

Equipment Qualification

11. (Open Item 53) Toshiba has implied that a Dedication Plan was created for the commercial grade acceptance of the PRM system. However, a dedication plan was not identified in the Qualification Plan for the PRM system. Please confirm if Toshiba created a Dedication Plan for the PRM system.

RESPONSE:

Toshiba did not prepare a separate Dedication Plan in addition to the Qualification Plan (FPG-PLN-C51-0003 Rev.3) for the PRM system.

Section 4 of the Qualification Plan describes "...a Qualification Plan for the NRW-FPGA-Based PRM System Qualification Project is established in addition to the Dedication Plan." By the description, Toshiba intended to describe that the Qualification Plan includes more information than the information required for a Dedication Plan. Toshiba will revise the description in this qualification plan to eliminate the apparent requirement for a separate Dedication Plan, which Toshiba did not generate.

Toshiba will docket the revised qualification plan by April 8, 2016.

NRC QUESTION 12:

Equipment Qualification

12. (Open Item 55) In the Qualification Test Summary Report (FPG-TRT-C51-0101), Toshiba justifies not performing aging test for the OPRM unit because of the design conditions in the Advance Boiling Water Reactor (ABWR) Design Control Document. However, it is not clear how this justification applies to the generic system described in the TR. Therefore, please explain why Toshiba did not conduct the radiation aging test for the OPRM unit.

RESPONSE:

The OPRM equipment is designed to be installed in the main control room. The main control room is expected to provide a mild environment (i.e., specified maximum and minimum temperature, humidity, and EMC conditions, and maximum radiation exposure rate and dose).

Section 50.49 of 10 CFR Part 50 defines the mild environment as an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences. A mild environment implies that equipment can be repaired as the equipment breaks, even during an accident. The IEEE standard clearly states that a mild environment does not require aging.

ABWR DCD states that electronic equipment subject to radiation exposure in excess of 10 Gy and other electrical and electrically driven mechanical equipment in excess of 100 Gy will be qualified in accordance with Section 50.49 of the 10 CFR Part 50. The thresholds described in the ABWR DCD are based on the industry knowledge, including electronic equipment radiation hardness. Toshiba understands that this data from the ABWR DCD is not specific to the ABWR design and can be applied to other plants as well.

NRC QUESTION 13:

Equipment Qualification

13. (Open Item 36) Superseded versions of numerous Regulatory Guides (RGs) and their endorsed Institute of Electrical and Electronics Engineers (IEEE) standards are used in Enclosure 2 of the TR and other Toshiba's documents, especially for the PRM system. Examples include RG 1.28, RG 1.168 through RG 1.173, IEEE Std. 323, IEEE Std. 344, etc. Justifications should be provided for using previous versions of RGs and endorsed IEEE standards if the current versions are not used.

RESPONSE:

Attachment 1 of this enclosure shows conformance to the current regulatory Guides.

NRC QUESTION 14:

Equipment Qualification

14. (Open Item 56) Section 9.1.8 of the EQ Test Plan for Safety-Related OPRM (FC51- 7012-1000, Rev. 2) states the operability and prudency test are not performed during seismic testing. According to Table 5-1 of EPRI TR-107330, the operability test and prudency test should be conducted during SSE. Please provide justifications for not conducting the operability and prudency test during the seismic test.

RESPONSE:

Toshiba estimated performing the operability test and the prudency test for the OPRM requires about a day long test. It would not be reasonable to extend the seismic testing for these long periods. Instead, Toshiba chose to monitor the equipment operation during the test and perform the operability and prudency tests before and after the tests. The input data that generates OPRM trip conditions were fed from the test equipment to the test specimen, and the outputs from the test specimen were monitored during the test. No failures were observed.

The process Toshiba opted to use is consistent with the testing performed for the Triconex Tricon and the Rolls-Royce Civil Nuclear SPINLINE 3 equipment, for which USNRC SERs have been granted.

NRC QUESTION 15:

Equipment Qualification

15. (Open Item 57) EPRI TR-107330 requires testing of the (watchdog) timer during the operability test. Please provide justifications for not including the (watchdog) timer test as one of the operability test items for the OPRM system.

RESPONSE:

Toshiba performed watchdog timer testing as part of the V&V activities as reported in Section 9.1.2 of the NICSD V&V report for OPRM (FC51-3704-1001 Rev.9) attached to TR Part IV. Failure of the watchdog timers would be detected during testing. Multiple levels of watchdog timers are provided in the equipment. Nothing performed during equipment qualification testing could change the behavior of the watchdog timers. Therefore, such testing was not repeated during equipment qualification, as appropriate testing under Toshiba's NQA-1 compliant nuclear quality assurance program had already been completed. In the PRM EQ where equivalent parts and circuits are implemented, the watchdog timer test was conducted after the EQ test. No error was found.

NRC QUESTION 16:

Equipment Qualification

16. (Open Item 58) The Electromagnetic Compatibility (EMC) Qualification Report for Safety-Related OPRM (FC51-7513-1001, Rev. 0) was issued on Nov. 8, 2013. However, Section 9.2.5.4 of this document states that the RS101 testing was performed in Fuchu Complex on December 28, 2013. Clarify this discrepancy. In addition, the EMC qualification tests were conducted from December 3, 2012, through January 7, 2013. But, Table 7-3 in this document states that calibration due date is July 31, 2013, for the measuring and test equipment. Please clarify why the calibration was conducted later than the tests.

RESPONSE:

For the discrepancy of date, Toshiba confirmed the date December 28, 2013, and the location described in Section 9.2.5.4 of FC51-7513-1001 was incorrect, and the correct date was December 28, 2012, and correct location was test facility in US. Toshiba will revise the document under Toshiba's corrective action program.

For the date of calibration, Toshiba recorded the next time that calibration (i.e., calibration due date) was required for each piece of the measuring and test equipment, demonstrating that the equipment would remain in calibration through the testing. In order to have that calibration sticker, the equipment had already been calibrated and the usable end date of that calibration recorded. Properly calibrated equipment was used throughout the testing and the calibration date did not expire during the tests.

NRC QUESTION 17:

Equipment Qualification

17. (Open Item 59) Sections 9.2.5 and 11.2 of the EMC Qualification Report for the OPRM (FC51-7513-1001) mention that varistors and noise filters were used during the EMC tests to improve the quality of the power source in order to comply with the EMC requirements. But, the varistors and noise filters were not included as part of the OPRM unit. If varistors and noise filters are not used, clarify what specific quality of the power source should have in order to meet the EMC requirements. In addition, if the power source is of poor quality, describe what technical specifications the varistors and noise filters should have in order to meet the EMC requirements

RESPONSE:

The varistors are not part of the OPRM system, and were used to improve the poor quality of the test facility's power source. The test facility provided power that did not support testing power line emissions without cleaning up the power provided to the Toshiba system. Varistors and filters were added to clean up the power before entering the measurement equipment and the Toshiba system. Toshiba selected the varistors and the filters with the test facility to clean up 60 Hz noise.

This power line filtering is not considered part of the Toshiba system configuration for qualification testing.

NRC QUESTION 18:

Equipment Qualification

18. (Open Item 60) Qualification Test Summary Report (FPG-TRT-C51-0101) documents the result of environmental qualification test and qualification analysis performed on the PRM system. This document does not include the wear aging test. Please explain if the wear aging test was performed for the PRM system.

RESPONSE:

As noted in USNRC RG 1.209, Rev. 0, Section B, discussion: "IEEE revised the industry guidance for qualification, IEEE Std. 323, in 2003. A particular distinction between IEEE Std. 323-2003, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" , and IEEE Std. 323-1974 , is that the current version does not require age conditioning to an end-of-installed-life condition for equipment in mild environments where significant aging mechanisms are not present. The practices in IEEE Std. 323-2003 are sufficiently comprehensive to address qualification for the less severe environmental conditions of typical plant locations where safety-related computer-based I&C systems are generally located. These plant areas are unaffected by design-basis accidents and the most severe

conditions to which the equipment is subjected, which arise from the environmental extremes resulting from normal and abnormal operational occurrences."

The modules comprising the APRM, LPRM, FLOW, and OPRM units are designed to be installed and operated only in a mild environment. These modules and units have no significant aging mechanisms. Therefore, aging is not required and thus was not performed during equipment qualification testing.

Note that the field inputs for these units are required to be qualified to the conditions to which the field input equipment is exposed. Aging and use life limits do apply to the field input equipment (e.g., neutron detectors or differential pressure transmitters). Field equipment was not included in this qualification, or in the TR.

NRC QUESTION 19:

Equipment Qualification

19. (Open Item 64) The OPRM Unit Detailed Specification (FC51-3702-1000) identifies a power factor correction module (PFC). This module is not included in the TR, Tables II-2-6 and II-B-1. However, Section II-A-3-1 of the TR lists two PFCs modules as part of the test specimen for the OPRM unit. Please clarify if the PFC module was part of the EQ testing. Additionally, confirm if the PFC module is part of the OPRM unit, and thus part of the system under review.

RESPONSE:

The PFC module is not part of the test specimen, and is out of the scope of review for the OPRM unit.

NRC QUESTION 20:

Commercial Grade Dedication

20. (Open Item 66) The Acceptance Checklist for Commercial Grade Item (ACLFPG-JOS-C51-0001-01) identifies the type of source verification for each critical characteristic. One of the method used is R (for Record Review). However, this checklist does not identify what specific record was reviewed to accept critical characteristics. Please describe what records were reviewed for accepting the critical characteristics of the PRM system.

RESPONSE:

The checklist does not identify a specific record. Toshiba retains paper-based records for this review. These records are test reports of the PRM equipment. The project name, document title, and the signature of a QA engineer on the cover sheets identify that these test reports are the records indicated by "R" in the acceptance checklist. The record review is used to verify that the testing performed satisfied the CGD acceptance criteria.

NRC can see the test reports during the audit.

NRC QUESTION 21:

Commercial Grade Dedication

21. (Open Item 69) The Acceptance Checklist for Commercial Grade Item (ACLFPG-JOS-C51-0001-01), Attachment 1, lists several references for the modules. Please explain what these references/documents are and how they were used for the acceptance of the PRM system.

RESPONSE:

Attachment 1 of the referenced document lists reference documents numbered "ATC-XXXXXX" (e.g., ATC0060418). These are test records for the modules. NRC can see these documents during the audit.

NRC QUESTION 22:

Preliminary Technical Evaluation Report

22. (Open Item 72) Section 4 of the Preliminary Technical Evaluation Report (PTER) (FPG-DRT-C51-0001) includes the following statement: "There are no "safety functions" for the PRM Test System to be procured for this project, since the project involves creating a Test System for qualification..." Please confirm the test specimen used during EQ testing included the logic necessary to perform the functions required by the PRM system.

RESPONSE:

Toshiba confirms that the PRM test specimen included the logic to perform the functions required by the PRM system.

The description in PTER means that the test specimen itself is not used as safety systems in an actual plant.

NRC QUESTION 23:

Preliminary Technical Evaluation Report

23. (Open Item 73) Section 4.3.2 of the PTER (page 21/60) identifies test equipment that were considered safety-related. Please confirm if this equipment was part of the test specimen.

RESPONSE:

Section 4.3.2 of PTER (FPG-DRT-C51-0001) identifies the following test equipment components:

- Trip Auxiliary Unit
- FLOW Unit (used to provide simulated FLOW signals to the Test Specimen)
- DI/DO Simulator
- LPRM/FLOW Signal Simulator
- Current Monitor Box
- Variable Power Supply
- Data Recorder
- Rack
- DC Power Supply
- Cables external to Test Specimen Units.

Toshiba confirms the equipment was not part of the test specimen.

NRC QUESTION 24:

Preliminary Technical Evaluation Report

24. (Open Item 74) In letter IM-2015-000152, action item 3, Toshiba agreed to provide in the responses explanations to the critical characteristics identified in Appendix A of the PTER. Please provide the information to supplement Appendix A of the PTER.

RESPONSE:

Attachment 2 of this enclosure provides Appendix A of the PTER as an information supplement.

NRC QUESTION 25:

System Description and Configuration

25. (Open Item 75) In its letter TOS-CR-PG-2015-0007, Toshiba provided responses to the staff request for additional information (RAI) questions. The response provided to Item 11 states: "Each rotary switch allows setting one or a series of digits." Please explain where Toshiba will provide the information to set the rotary switches for each module in the PRM system and OPRM unit.

RESPONSE:

The information to set the rotary switches is given in the module design specification (MDS) for each module. Attachment 3 of this enclosure, Use of Rotary Switches in the PRM and OPRM Modules, summarizes the information on the rotary switches with the section of the MDS in which the information is described.

NRC QUESTION 26:

System Description and Configuration

26. (Open Item 76) In its letter TOS-CR-PG-2015-0007, Toshiba provided responses to the staff RAI. The response provided to item 16 states: "TRN and RCV modules were qualified with the OPRM. These modules can be applied to the PRM." Since these modules were not included in the test specimen for the PRM qualification, please explain why these modules can be used with the PRM system for BWR-5.

RESPONSE:

The differences between the new TRN and RCV modules, which were qualified with the OPRM, and the old TRN and RCV modules are described below. The first three differences are modifications of FPGA logic only; the fourth difference is a change in grounding connection of the modules

(1) Addition of cyclic redundancy check (CRC) data to the fiber optic communication links.

No matter in which mode the TRN module operates, the TRN module sends out the multiplexed data frame to other units or other systems through a fiber optic communication link.

The RCV module receives the data sent from the TRN modules through fiber optic cable from another unit and extracts the data from the message.

The CRC is computed in the programmable logic in the message sender (TRN module) and separately in the message receiver (RCV module). The message sender applies an initialized 32-bit polynomial calculation to a block of data that is to be transmitted and appends the resulting CRC to the block. The receiving end applies the same initialized polynomial calculation to the data and compares its result with the result appended by the sender. If the transmitted CRC agrees with the CRC computed by the receiver, the data has been received successfully.

Since the CRC is just a computed value from a polynomial calculation and does not require any additional hardware for the Toshiba implementation, the CRC can be added in the TRN or RCV module by changing only the FPGA logic without changing the module's printed circuit board.

The IEEE Std. 7-4.3.2-2003, Clause 5.4.1, Computer System Testing, states:

> Computer system qualification testing (see 3.1.36) shall be performed with the computer functioning with software and diagnostics that are representative of those used in actual operation. All portions of the computer necessary to accomplish safety functions, or those portions whose operation or failure could impair safety functions, shall be exercised during testing. This includes, as appropriate, exercising and monitoring the memory, the CPU, inputs and outputs, display functions, diagnostics, associated components, communication paths, and interfaces. Testing shall demonstrate that the performance requirements related to safety functions have been met.

For the OPRM testing, the CRC checks were included in the equipment qualification testing. For the PRM testing, the CRC checks were not included, but the remainder of the software functionality, "representative of those used in actual operation" was in place. Even with the CRC check, the FPGA logic in the modules was still representative of the FPGA logic (with the CRC check) that will be applied and is within the allowance for FPGA logic changes provided above in the endorsed standard.

(2) Method of RCV Module Self Diagnosis

In addition to adding the CRC that improves the detection of data communication error, Toshiba enhanced other associated self-diagnostic capability in RCV module. As described in Appendix II-B of UTLR-0020P, the RCV module checks for periodic receipt of the data frame. The new RCV module includes enhanced self-diagnostics to reduce false data error signals. The self-diagnostics detect when the fiber optic links are incorrectly connected.

(3) Use of unused part in the data frame

As described in Appendix II-B of UTLR-0020P, the TRN module transmits a fixed format data frame over the fiber optic link. The format of the data frame is common to all communications, i.e., communications from the LPRM unit to the LPRM/APRM unit, from the FLOW unit to the LPRM/APRM unit, and from the LPRM/APRM unit to external equipment. The new TRN and RCV modules qualified with the OPRM unit use the same format except the added CRC described in (1). Besides the CRC, the data format divides the data frame into a number of fixed length channels (or fields). The design of the PRM or OPRM communication determined the content of each channel for these communications. In the design of the OPRM communication, the new TRN module was modified to use an unused part of one channel of the data frame to transfer OPRM specific data to include the sequence number of each data frame transmitted. In the OPRM, the DAT/ST module generates a sequence of data frames to send a complete set of data to other external systems. Starting with the original TRN module programmable logic, Toshiba added the sequence number to an unused part of one channel of a data frame. The sequence number is included in each data frame so that the receivers can check that they are receiving the data in the correct sequence. The DAT/ST module inserts the OPRM specific data into the data frame while generating the data frame. The data frame is sent to the TRN module through the middle plane, and the TRN module transmits the data frame over a fiber optic link.

(4) Grounding method of the optical transmitter (TRN module) and the optical receiver (RCV module) to a sub-board, and grounding method of the sub-boards to the front panel.

This change was made to reduce susceptibility to electrostatic discharge (ESD). The change has no effect on the data processing in the TRN and RCV modules, because no signal line or data processing logic was changed.

The TRN module is used in the LPRM unit, Flow unit, and LPRM/APRM unit in the PRM system and in the OPRM unit in the OPRM system. Although the TRN module has different operational modes depending on the unit into which it is inserted, these operational modes relate to the methods in which the TRN module collects the data and transmits to other modules in the same unit through the middle plane, or transmits the data to other units through fiber optic cable. The operational mode is determined by the hardwired signal provided through the middle plane in each unit.

Since the TRN and RCV modules work in different units without changing anything except the rotary switch setting for Unit ID in the module as described in the response to NRC Question 25 above, Toshiba concludes the new TRN and RCV modules, qualified through the OPRM equipment qualification testing, can and shall be used in the PRM and OPRM systems.

NRC QUESTION 27:

System Description and Configuration

27. (Open Item 77) Section II-A-2.7 of the TR describes self-diagnostic capabilities for the system. This section includes the following sentence: "If only a single value is being communicated, data update checks using refresh counts and timeout checks are provided." Please clarify the meaning of this sentence.

RESPONSE:

The term "a single value" means an LPRM level that is communicated over the middle plane without being multiplexed. Each LPRM module inserted in the LPRM or LPRM/APRM unit transmits its LPRM level as a single unsigned value with the refresh count, which the LPRM module counts up each time it transmits the new value, and returns to zero when the count reaches its upper limit. The receiver logic checks that a new count has been provided and that the communication link has not timed out.

NRC QUESTION 28:

System Description and Configuration

28. (Open Item 78) Section II-A-3.2 of the TR describes the OPRM configuration. This section includes the following sentence: "The logic inside each FPGA was identical to what would be shipped to a BWR." It is our understanding that there are differences between the OPRM configuration for the ABWR design and for the BWR design, and these differences will require modifications to the OPRM (e.g., number of LPRM). Therefore, it is not clear how the logic in the FPGA can be identical. Please clarify the meaning of this sentence.

RESPONSE:

As being pointed out, "The logic inside each FPGA was identical to what would be shipped to a BWR" is incorrect.

The sentence in the TR will be corrected to state that the logic inside each FPGA in the OPRM test specimen for the qualification testing was identical to what would be shipped to an ABWR, and that the number of LPRMs would need to be adjusted in the logic for use in other BWR types.

NRC QUESTION 29:

System Description and Configuration

29. (Open Item 79) Section II-A-7 of the TR describes the PRM system configuration for BWRs. This section includes the following sentence: "Replacement of the LPRM, APRM, and OPRM together is best performed using fiber optic communication and modules that have already been type tested." Please clarify the meaning of this sentence.

RESPONSE:

The sentence means that when the LPRM, APRM, and OPRM are all replaced at the same time, fiber optic communication links between the LPRM/APRM and OPRM will be used, and using the TRN and RCV modules that are already type tested.

Attachment 1 Conformance to Current Regulatory Guide

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
1	**Reg. Guide 1.22** "Periodic Testing of Protection System Actuation-Functions"	0	0	0
2	The same revision was used, no Issue.			
3	**Reg. Guide 1.28** "Quality Assurance Program Requirements (Design and Construction)" (Task RS 002-5)	4	3	3
4	Rev. 3 endorses ANSI/ASME NQA-1-1983 and NQA-1a-1983. Rev. 4 endorses ASME NQA-1-2008 and NQA-1a-2009.		NQA-1-1994 was used for the PRM development. The 2008/2009 version expands requirements on the software life cycle in subpart 2.7. Since Toshiba complied with IEEE software standards (see the responses to Reg. Guide 1.152, 1.168 through 1.173), the requirements in subpart 2.7 were covered.	Toshiba Nuclear Energy QA Program Description and second level QA documents complies with NQA-1-2008/2009 in addition to NQA-1-1994 since 2011. Toshiba used NQA-1-2008/2009 since then. Toshiba complied with IEEE software standards (see the responses to Reg. Guide 1.152, 1.168 through 1.173), the requirements in NQA-1-2008 subpart 2.7 were covered.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
5	**Reg. Guide 1.29** "Seismic Design Classification"	4	3	4
6	Rev. 4 invokes Reg. Guide 1.189 "Fire Protection for Operating Nuclear Power Plants."		Not an issue for this TR.	Not an issue for this TR.
7	**Reg. Guide 1.47** "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems"	1	0	0
8	Rev. 1 includes guidance for digital computer-based I&C systems, stating that Annunciating functions for system failure and automatic actions based on the self-test or self diagnostic capabilities of digital computer-based I&C safety systems should be consistent with Positions 1 and 2 above.		Toshiba provided outputs for Bypass and Inoperable Status Indications, including diagnostics, in the equipment.	Toshiba provided outputs for Bypass and Inoperable Status Indications, including diagnostics, in the equipment.
9	**Reg. Guide 1.53** "Application of the Single-Failure Criterion to Safety System"	2	2	2
10	The same revision was used, no Issue.			
11	**IEEE Std 379** "Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems"	(2000)	(2000)	(2000)
12	The same revision was used, no Issue.			

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
13	**Reg. Guide 1.75** "Criteria for Independence of Electric Safety Systems"	3	2	3
14	Rev.2 endorses IEEE Std 384-1974. Rev.3 endorses IEEE Std 384-1992.		Toshiba used IEEE Std 384-1992, which is invoked by RG 1.75 Rev. 3. Section 3 of the RG includes the requirements concerning physical independence of the circuits and electrical equipment that comprise or associated with safety systems. Toshiba considers that these requirements are not applicable to individual electrical devices such as PRM, but to electrical equipment in the plants. Toshiba will consider the requirements when the PRM is installed in plants.	---
15	**IEEE Std 384** "Standard Criteria for Independence of Class 1E Equipment and Circuits"	(1992)	(1992)	(1992)
16	The same revision was used, no Issue.			
17	**Reg. Guide 1.89** "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants"	1	1	Not referenced.
18	---		Since this equipment is qualified for mild environments, portions of RG 1.89 no longer apply.	Since this equipment is qualified for mild environments, portions of RG 1.89 no longer apply.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
19	**IEEE Std 323** "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations"	(1974)	(1983)	(2003)
	See the rows under Reg. Guide 1.209, which endorses IEEE Std 323.			
20	**Reg. Guide 1.100** "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants"	3	2	2
21	Rev.2 endorses IEEE Std 344-1987. Rev.3 endorses IEEE Std 344-2004 and ASME QME-1.		See next lines for the impact of the change.	See next lines for the impact of the change.
22	Rev.3 states that use of experience data for the seismic qualification of electrical equipment is subject to review by the NRC staff. (C 1.1.1 b)		Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.	Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.
	Rev.3 states that if the licensee/applicant proposes to use test experience data for seismic qualification in accordance with IEEE Std. 344-2004, Clause 10.3, the licensee should submit, for staff review and approval,. (C 1.1.1 d)		Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.	Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
23	**IEEE Std 344** "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"	(2004)	(1987)	(1987)
24	The 2004 version augments qualification by experience in Clause 10.		Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.	Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.
25	The 2004 version provides conditions to qualify inherently seismic rugged equipment, for which the rules may be simplified and reduced in Clause 10.4.1.		Toshiba tested, considering the PRM non-rugged equipment. No effect on the topical report.	Toshiba tested, considering the OPRM non-rugged equipment. No effect on the topical report.
26	The 2004 version provides limitations of earthquake or test experience-based qualification in Clause 10.4.2.		Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.	Toshiba tested. Toshiba did not use experience data for seismic qualification. No effect on the topical report.
27	**Reg. Guide 1.105** "Setpoints for Safety-Related Instrumentation"	3	3	3
28	The same revision was used, no Issue.			
29	**ISA-S67.04** "Setpoints for Nuclear Safety-Related Instrumentation"	(1994)	(1994)	(1994)
30	The same revision was used, no Issue.			

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
31	**Reg. Guide 1.152** "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants"	3	2	3
32	Revision 3 uses the word "SDOE" instead of cyber-security, and refers to Reg. Guide 5.71.		Toshiba evaluated the nine regulatory positions in the Reg. Guide 1.152 Rev. 2, and concluded that the cyber security requirements required for Toshiba's compliance with the vendor's portions of the cyber security program defined in Regulatory Positions 2.1 through 2.9 are embodied in the process used for the PRM. SDOE issues therefore involve the computers used to design and develop the FPGA-based systems. Firewalls, virus scanning software, and other commercially available technology protect Toshiba's design information and resources from external attacks. [redacted]^a	Toshiba solidified the cyber-security measures based on the practice of the PRM, and improved them as necessary for SDOE. SDOE was maintained through the life cycle.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
33	**IEEE Std. 7-4.3.2** "Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations"	(2003)	(1993)	(2003)
34	The 2003 version introduced use of software quality metrics throughout the software life cycle. (Section 5.3.1.1)		The V&V activities monitored metrics defined for the project throughout the life cycle.	The V&V activities monitored metrics defined for the project throughout the life cycle.
	The 2003 version states two methods for the use of software tools: a) a tool shall be validated, or b) defects not detected by the software tool will be detected by V&V activities. (Section 5.3.2)		Toshiba identified and evaluated the software tools used in the developments. In addition, Toshiba performed V&V activities, including check of FPGA netlists and multi-level validation testing, to detect possible remaining defects.	Toshiba identified and evaluated the software tools used in the developments. In addition, Toshiba performed V&V activities, including check of FPGA netlists and multi-level validation testing, to detect possible remaining defects.
35	The 2003 version requires performing V&V in accordance with IEEE Std 1012-1998. (Section 5.3.3)		No impact. The 1998 version of IEEE Std 1012 was used for V&V.	No impact. The 1998 version of IEEE Std 1012 was used for V&V.
36	The 2003 version introduced independent V&V requirements. (Section 5.3.4)		The V&V activities were performed by V&V teams independent of the development teams.	The V&V activities were performed by V&V teams independent of the development teams.
37	The 2003 version changed the requirements to software configuration management (SCM), so that SCM shall be performed in accordance with IEEE Std 1042-1987. (Section 5.3.5)		Toshiba performed SCM in accordance with Reg. Guide 1.169, Rev.0 of which endorsed IEEE Std 1042-1987.	Toshiba performed SCM in accordance with Reg. Guide 1.169, Rev.0 of which endorsed IEEE Std 1042-1987.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	**Rev. (Year)**	**Used Rev. (Year)**	**Used Rev. (Year)**
	Changes		**Conformance Evaluation**	
38	The 2003 version introduced software project risk management. (Section 5.3.6)		Risk management was included in the V&V activities through the life cycle phases.	Risk management was included in the V&V activities through the life cycle phases.
39	The 2003 version recognizes the need to qualify existing commercial computers. (Section 5.4.2.)		No impact. The commercial software tools were dedicated. See FPG-PLN-C51-0003 "Qualification Plan."	No impact. The commercial software tools were dedicated.
40	The 2003 version introduced Fault detection and self-diagnostics requirements. (Section 5.5.3)		The PRM system has multi-level fault diagnostics, and they were subjected to the V&V process.	The PRM system has multi-level fault diagnostics, and they were subjected to the V&V process.
41	The 2003 version provides detailed identification requirements for software system. (Section 5.11)		Toshiba installed and will install the FPGA logic identified under its configuration management which verifies correct programmable logic installation.	Toshiba installed and will install the FPGA logic identified under its configuration management which verifies correct programmable logic installation.
42	**Reg. Guide 1.153** "Criteria for Safety Systems"	1	1	1
43	The same revision was used, no Issue.			
44	**IEEE Std 603** "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations"	(1991)	(1991)	(1991)
45	The same revision was used, no Issue.			
46	**Reg. Guide 1.168** "Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"	2	1	1

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
47	Rev.2 endorses IEEE Std 1012-2004, however, does not support "Security Analysis" a newly introduced V&V activity in 2004 version.		No Impact, security analysis (the same as SDOE in RG 1.152) is required by and discussed in RG 1.152.	No Impact, security analysis (the same as SDOE in RG 1.152) is required by and discussed in RG 1.152.
48	Rev.2 states that one of the main differences between the 2008 and 1997 versions of IEEE Std. 1028 is the addition of an anomaly ranking and reporting found in Clause 6.8.3, which is part of "inspections," and states that anomalies shall be ranked by potential impact.		Although Toshiba did not use formal inspections as a method of software reviews, Toshiba used a similar ranking concept in the hazard analyses.	Although Toshiba did not use formal inspections as a method of software reviews, Toshiba used a similar ranking concept in the safety analyses.
49	Rev.2 states the IEEE Std 1012-2004 version added a conditional independence option in Annex C and "Security Analysis," both of which the NRC does not support.		No Impact. Toshiba did not use this approach	No Impact. Toshiba did not use this approach
50	Rev.2 states that "audits should be" performed and relied on by the V&V organization. Rev.1 states "audits may be."		The Quality Assurance (QA), NED conducted audits of NICSD annually, including the software process documents and processes applied. The NED V&V Team provided oversight of NICSD activities as described in the TR Part V. The scope of the oversight includes: ● Organization, ● Design control, and ● Test control.	The Quality Assurance (QA), NED conducted audits of NICSD annually, including the software process documents and processes applied. The NICSD IV&V Team provided oversight of NICSD activities as described in the TR Part V. The scope of the oversight includes: ● Organization, ● Design control, and ● Test control.
51	Rev.2 endorses Figure F.1 "V&V organizational relationships" in Annex F of IEEE Std 1012-2004.		The V&V Plan includes an organization relationships figure similar to Figure F.1.	The V&V Plan includes an organization relationships figure similar to Figure F.1.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
52	**IEEE Std 1012** "IEEE Standard for Software Verification and Validation"	(2004)	(1998)	(1998)
53	The 2004 version defines "Security Analysis" as a new task through life cycle.		See RG 1.152 response.	See RG 1.152 response.
54	The 2004 version defines the following new tasks other than "Security Analysis:" - "Identify process improvement opportunities in the conduct of V&V" as a management activity. - "Acceptance Support" in Acquisition.		For process improvement opportunities, the QA management reviews include assessment and improvement of the activity.	For process improvement opportunities, the QA management reviews include assessment and improvement of the activity.
55	**IEEE Std 1028** "IEEE Standard for Software Reviews and Audits"	(2008)	(1997)	(1997)
	The 2008 version has no outstanding change from the 1997 version. Both versions define the responsibility, input, entry criteria, procedures, exit criteria, and output for the management reviews, technical reviews, inspections, walk-through, and audits.		No Impact, because Toshiba used IEEE Std 1028 as a guide, not strictly conforming to.	No Impact, because Toshiba used IEEE Std 1028 as a guide, not strictly conforming to.
56	**Reg. Guide 1.169** "Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"	1	0	0
57	Rev. 0 endorsed ANSI/IEEE Std 1042-1987 and IEEE Std 828-1990. Rev. 1 endorses IEEE Std 828-2005		See next lines for the impact of the change.	See next lines for the impact of the change.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
58	Rev. 1 addresses new areas, "Release Management and Delivery" and security features.		"Release Management and Delivery" has not been conducted yet. For security features, see the response to RG 1.152.	"Release Management and Delivery" has not been conducted yet. For security features, see the response to RG 1.152.
59	Rev. 1 adds the following configuration items for safety system documentation: b. data files used and called directly or indirectly by software; j. test cases		The added configuration items were included in the MCL for PRM, including the data installed in the ROMs in the PRM modules.	The added configuration items were included in the MCL for OPRM including the data installed in the ROMs in the OPRM modules.
60	**IEEE Std 828** "IEEE Standard for Software Configuration Management Plans"	(2005)	(1990)	(1990)
61	The 2005 version includes Clause 3.3.7 "Release management and delivery."		See RG 1.168 response.	See RG 1.168 response.
62	The 2005 version includes security features in acquiring configuration items,		See RG 1.152 response.	See RG 1.152 response.
63	The 2005 version includes security features in Subcontractor/vendor control, and		Control of the subcontractor, NICSD, and acquisition of their products were performed under the Commercial Grade Dedication program, which provides a superset of the required activities. NED and NICSD operated under the Toshiba cyber security program, documented in the response to RG 1.152.	Control of subcontractors including PPDD and acquisition of their products were performed under the Commercial Grade Dedication program, which provides a superset of the required activities. NED, NICSD, and PPDD operated under the Toshiba cyber security program, documented in the response to RG 1.152.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
64	The 2005 version includes security features release management and delivery.		Release management and delivery has not yet been performed.	Release management and delivery has not yet been performed.
65	**Reg. Guide 1.170** "Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"	1	0	0
66	Rev. 0 endorsed IEEE Std 829-1983. Rev. 1 endorses IEEE Std 829-2008.		See next lines for the impact of the change.	See next lines for the impact of the change.
67	Rev. 1 recommends use of the Integrity level schemes and life-cycle processes for the appropriate test activities.		The software test activities were defined in the NED V&V Plan as life-cycle activities, in which the software integrity level was defined.	The software test activities were defined in the NICSD V&V Plan as life-cycle activities, in which the software integrity level was defined.
68	Rev. 1 states the life-cycle processes should demonstrate adequate testing and error resolution documentation with retesting, which is sustained by an Anomaly Report (AR). (C. 1. Test Program)		All problems found in the testing were documented and appropriately dispositioned.	All problems found in the testing were documented and appropriately dispositioned.
69	Rev. 1 states some acceptance test procedures may have an open entry location within the document, appendix or attachment to record the data and testing status. To meet the activity and event entry per Clause 13, "Level Test Log," an acceptable method for eliminating or combining test documents is to use the procedure and log as the same document (e.g., Factory Acceptance Test Procedures). (C. 2. Test Documentation)		See IEEE Std 829 Response.	See IEEE Std 829 Response.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
70	Rev. 1 states that the test documentation must be signed-off by all designated stakeholders. (C. 3. Test Documentation)		This PRM was developed internally for the qualification purpose. All test documentation was signed-off by Toshiba internal stakeholders in accordance with internal procedures.	This OPRM was developed internally for the qualification purpose. All test documentation was signed-off by Toshiba internal stakeholders in accordance with internal procedures.
71	Rev. 1 states it is not acceptable to lower the integrity level of documentation when incorporating individual documents into larger test documents. (C. 3. Test Documentation)		Toshiba used a similar software integrity level (SIL), and assigned SIL 4 (highest) to the PRM, in order to meet the Regulatory Position 1 of RG. 1.168 Rev. 1.	Toshiba used a similar software integrity level (SIL), and assigned SIL 4 (highest) to the OPRM, in order to meet the Regulatory Position 1 of RG. 1.168 Rev. 1.
72	Rev. 1 states a normal or failure recovery should be included as a test requirement. (C. 4. System Testing)		While written for "licensees," Toshiba has tested the recovery processes for identified faults and failures within the PRM. Final system configuration testing will be performed by both Toshiba and the utility applying the PRM.	While written for "licensees," Toshiba has tested the recovery processes for identified faults and failures within the OPRM. Final system configuration testing will be performed by both Toshiba and the utility applying the OPRM.
73	Rev. 1 states the test documentation should include references to traceability analyses relating functions and test cases unless the equivalent traceability information are maintained elsewhere in the V&V records. (C. 5. Traceability)		Requirements traceability matrices (RTMs) were prepared to relate between the functions and test cases in the V&V efforts. The RTMs are separate documents, and not incorporated in the test documentation.	Requirements traceability matrices (RTMs) were prepared to relate between the functions and test cases in the V&V efforts. The RTMs are separate documents, and not incorporated in the test documentation.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
74	Rev. 1 states the licensee or applicant should assign integrity level 4 or the equivalent to software used in nuclear power plant safety systems. (C. 6. Integrity Levels)		Toshiba used a similar software integrity level (SIL), and assigned SIL 4 (highest) to the PRM, in order to meet the Regulatory Position 1 of RG. 1.168 Rev. 1.	Toshiba used a similar software integrity level (SIL), and assigned SIL 4 (highest) to the OPRM, in order to meet the Regulatory Position 1 of RG. 1.168 Rev. 1.
75	Rev. 1 states applicants should consider the recommendations in Annex C including lists the minimum testing tasks for each life-cycle process steps. (C. 7. Testing Tasks)		Toshiba's V&V activities included applicable testing tasks in the development of FPGA-Based systems, i.e., tasks in management process and development process. The V&V process did not include plant installation and checkout.	Toshiba's V&V activities included applicable testing tasks in the development of FPGA-Based systems, i.e., tasks in management process and development process. The V&V process did not include plant installation and checkout.
76	Rev. 1 takes an exception to Clause 6.3 of IEEE Std 829-2008 stating that there is no need for repetition of test information if completely managed by an automated tool with references for tracing the information. Rev.1 states that the tools used in the development of safety system software should be handled according to IEEE Std. 7-4.3.2-2003, as endorsed by Regulatory Guide 1.152. (C. 8. Test Tool Documentation)		Toshiba handled tools according to IEEE Std 7-4.3.2-2003.	Toshiba handled tools according to IEEE Std 7-4.3.2-2003.
77	Rev. 1 states that The identification of the security issues task should be included in the process activities of "Acquisition," "Supply," "Planning," and "Concept" life-cycle phases in Table 3 and Clause 5. (C. 9. Security Analysis)		No Impact. Toshiba maintained cyber security measures in accordance with Reg. Guide 1.152 Rev.2.	No Impact. Toshiba maintained cyber security measures in accordance with Reg. Guide 1.152 Rev.3.
78	**IEEE Std 829** "IEEE Standard for Software Test Documentation"	(2008)	(1983)	(1983)
79	The 2008 version of IEEE Std 829 introduced Master Test Plan (MTP) that provides an overall test planning and test management for multiple levels of test.		The NED V&V Plan provides an overall test planning and management.	The NICSD V&V Plan and the MTP provides an overall test planning and management.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
80	Clause 8 of the 2008 version requires the following descriptions in the MTP: ● List of all the applicable documents including government regulations and standards; ● Organization, the relationship of the test processes to other processes; ● Mater test schedule; ● Integrity level; ● Resource summary; ● Metrics.		The NED V&V Plan includes the descriptions required by the 2008 version.	The NICSD V&V Plan includes the descriptions required by the 2008 version.
81	Clause 8 of the 2008 version requires descriptions on tools, techniques, and methods in the MTP.		The test planning documentation provides tools, techniques, and methods.	The test planning documentation provides tools, techniques, and methods.
82	Clause 8 of the 2008 version requires the following descriptions in the MTP: ● Test processes including definition of test levels; ● "Life cycle" processes; ● Test documentation requirements; ● Test administration requirements; ● Test reporting requirements.		The NED V&V Plan includes the descriptions required by the 2008 version.	The NICSD V&V Plan includes the descriptions required by the 2008 version.
83	**Reg. Guide 1.171** "Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"	1	0	0
84	No outstanding change.		No issue	No issue

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
85	**IEEE Std 1008** "IEEE Standard for Software Unit Testing"	(1987)	(1987)	(1987)
86	The same revision was used, no Issue.			
87	**Reg. Guide 1.172** "Software Requirements Specifications for Digital Computer Software and Complex Electronics Used in Safety Systems of Nuclear Power Plants"	1	0	0
88	Rev. 0 endorsed IEEE Std 830-1993; Rev. 1 endorses IEEE Std 830-1998. Rev. 1 refers to SDOE.		See RG 1.152 response for SDOE.	See RG 1.152 response for SDOE.
89	**IEEE Std 830** "IEEE Recommended Practice for Software Requirements Specifications"	(1998)	(1998)	(1998)
90	The same revision was used, no Issue.			
91	**Reg. Guide 1.173** "Developing Software Life-cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"	1	0	0
92	Rev. 0 endorsed IEEE Std 1074-2006. Rev. 1 endorses IEEE Std 1074-1995		See next lines for the impact of the change.	See next lines for the impact of the change.
93	Rev. 1 states that security analysis in IEEE Std. 1074-2006 is exception. Instead SDOE in RG 1.152 is referenced.		See RG 1.152 response for SDOE.	See RG 1.152 response for SDOE.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	**Rev. (Year)**	**Used Rev. (Year)**	**Used Rev. (Year)**
	Changes		**Conformance Evaluation**	
94	IEEE Std 1074-2006 drops Clause 3.3 "Software Quality Management Process" in the 2006 version.		Software quality assurance and quality control is provided as required by other standards.	Software quality assurance and quality control is provided as required by other standards.
95	Rev. 1 states that a temporary work-around is not permitted in any safety system unless all software changes are performed in accordance with the software configuration controls and the changed software is checked in an off-line mode prior to installation.		All software changes were performed in accordance with the software configuration controls. No identified issues or concerns remain in the software, thus no work-around is required.	All software changes were performed in accordance with the software configuration controls. No identified issues or concerns remain in the software, thus no work-around is required.
96	**IEEE Std 1074** "IEEE Standard for a Developing Software Life Cycle Process"	(2006)	(1997)	(1997)
97	The 2006 version defines "A.1.3 Project Planning Activity Group" to address the following planning for all project management. ● Develop Software Project Life Cycle Process (SPLCP) ● Perform Estimation ● Allocate Project Resource ● Define Metrics ● Determine Security Objectives.		The following planning documents covers the activities of A.1.3: ● Software Quality Assurance Plan. ● NED V&V Plan.	The following planning documents covers the activities of A.1.3: ● NED and NICSD Software Management Plans, ● NED and NICSD V&V Plan.
98	The 2006 version defines "A.1.3.6 Close Project" activity to formally conclude a project.		The V&V report, which was approved by the Project Manager, concluded the project.	The final Base Line Review concluded the completion of the OPRM development. The Project Manager approved the final Base Line Review Report.

No	Current Regulatory Guides and Endorsed Standards		PRM	OPRM
	Document No. and Title	Rev. (Year)	Used Rev. (Year)	Used Rev. (Year)
	Changes		Conformance Evaluation	
99	**Reg. Guide 1.180** "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems"	1	1	1
100	The same revision was used, no Issue.			
101	**Reg. Guide 1.209** "Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants"	0	-	0
102	No change		No issue	No issue
103	**IEEE Std. 323** "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations"	(2003)	(1983)	(2003)
104	The 2003 version simplifies the requirements for mild environment documentation in Clause 7.1.		Toshiba compiled with the content of 2003 version for the PRM, because the 2003 version changes do not impact the PRM.	No issue
105	The 2003 version adds requirements for EMI/RFI and power surges.		Toshiba performed qualification for EMI/RFI and power surges in accordance with regulatory requirements.	No issue
106	**Reg. Guide 5.71** "Cyber Security Programs for Nuclear Facilities," January 2010	0	---	0
107	---		Does not apply to Toshiba, but applies to licensees using the PRM or OPRM. Toshiba used only to ensure equipment is built and controlled in a manner that can be accepted by licensee.	

Attachment 2 Explanation for Appendix A of PRM PTER

1 Introduction

This document explains the methods Toshiba used to identify the critical characteristics (CCs) listed in Appendix A of the PRM PTER (FPG-DRT-C51-0001 Rev.10). This document provides additional information on Toshiba's plans to confirm the CCs.

2 General Explanation

In the following table, Columns A to N are copied from Appendix A of the PRM PTER (FPG-DRT-C51-0001 Rev.10) and fitted in the letter size. Column O is added to provide further explanation of each row in the table. Generic explanations of the table content are as follows:

1. Column A shows the applicable sections of EPRI TR-107330, if any, that could be associated with the requirements described in the document section identified in Columns B and C.
2. Column B shows the document and Column C shows the sections of the document where the Critical Characteristics (CCs) are described.
3. Columns D to H define the method Toshiba planned to use to confirm the CC. If Columns D to H are blank, the method is defined in Column J.
4. An "X" mark in Column D means the CCs were planned to be confirmed by the acceptance process invoked by the procurement of the Commercial Grade (CG) Item.
5. An "X" mark in Column E means the CCs were planned to be confirmed by the acceptance process invoked by the procurement of the CG Services. For the CCs planned to be confirmed by procurement of CG Services, the CCA for the services are described in PTER Sections 4.3.3 and 4.3.4 (FPG-DRT-C51-0001 Rev.10). Toshiba developed an Acceptance Plan for the CG Services based on the CCA for the CG Services described in PTER Sections 4.3.3 and 4.3.4.
6. An "X" mark in Column F means the CCs were planned to be confirmed by qualification analysis. The CCs were planned to be confirmed by availability/reliability analysis, FMEA, or setpoint support analysis.
7. An "X" mark in Column G means the CCs were planned to be confirmed by equipment qualification type tests. The CCs were planned to be confirmed by the successful completion of equipment qualification testing.
8. An "X" mark in Column H means the CCs were planned to be confirmed by evaluation and qualification of the software lifecycle used to develop the product. The CCs were planned to be confirmed through V&V activities.
9. An "X" mark in Column I means the CCs were planned to be confirmed by post-qualification activities such as preparation of an application guide based on the result of the qualification.

10. An "X mark in Column K means the CCs contains Critical Characteristics for Design (CCD) for CG Item.
11. Column L provides a text description of the activities planned to be performed. For some rows, procurement of the CGI provides sufficient assurance, which is true when no items are checked in Columns E through I. For CCs planned to be confirmed by procurement of CG Items, the Critical Characteristics for Acceptance (CCA) for the CG Items are shown in column L. An Acceptance Plan for the CG Items was developed by assembling the CCA for the CG Items shown in column L.
12. Column M provides an indication of the acceptance method to confirm the CCs. Four conditions exist in this column. The cell may be blank which means the CCs were planned to be confirmed by a method other than the acceptance method for CG Items/CG Services or qualification test. The cell may contain "Acceptance Method" which means the CCs were planned to be confirmed by the acceptance method for CG Items/CG Services. The cell may contain "Qualification Test" which means the CCs were planned to be confirmed by the qualification test. The cell may contain "Acceptance Method, Qualification Test" which means the CCs were planned to be confirmed by the acceptance method for CG Items/CG Services and the qualification test.
13. Column N indicates whether this item is completed once, is performed every time hardware or software applied, or is completed after equipment qualification type testing completes. "Recurring" in this column means the item is performed every time hardware or software applied. "at Qualification Test" in this column means the items is completed after equipment qualification type testing completes.
14. Explanation for each item is provided in column O of the table.
15. In the table, there are some exceptions from the generic explanations described above. Explanations for those exceptions are also provided in Column O of the table.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by						Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification	Post-Qualification Activities						
	E05R-001-R0	Observation No.5 of CG Survey Report	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Verification of design tool	Acceptance Method	Recurring	Observation No.5 of the CG Survey Report (E05R-001-R0) provides the Critical Characteristic (CC) to be confirmed. Observation No.5 says: "NICSD shall perform verification such as in-use-test for design tool. Moreover, when NICSD received notification of errors from tool vendor, NICSD shall implement evaluation of impact reviews/verification." Verification of the design tool was confirmed in the assessment of software tools in the NICSD V&V ac ivities documented in the NICSD's V&V report. The acceptance plan uses source verification (Method 3) as the acceptance method. .
	E05R-001-R0	Observation No.6 CG Survey Report	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	V&V activities in accordance with IEEE1012, R.G1.168.	Acceptance Method	Recurring	Observation No.6 of the CG Survey Report (E05R-001-R0) provides the Critical Characteristic (CC) to be confirmed. Observation No.6 says: "NICSD shall perform independent review of the design output documents and to generate the test plan and procedure in V&V ac ivity to meet NED procurement requirements that are in compliance wi h RG 1.168 and IEEE 1012." Column L describes that "V&V activities in accordance with IEEE1012, R.G 1.168" are Critical Characteristics for Acceptance (CCA) for CG Items. The V&V activities conducted by NICSD were reviewed and confirmed by NICSD's V&V report which is required by Toshiba's processes and procedures. The acceptance plan uses source verification (Method 3) identified as the acceptance method.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.5.4 4.5.6.A 4.5.6.B 4.9.3	ERS	5.1.1 Basic Design Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Unit Model Numbers Quality of Design and Manufacture	Acceptance Method	Recurring	The following are identified in the Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1): -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers". -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture"
4.2.3.7.C 4.4.1.2.D 4.4.1.2.I 4.4.6.3	ERS	5.1.2 System Initialization Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Unit Model Numbers Quality of Design and Manufacture	Acceptance Method	Recurring	The following are identified in the Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1): -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers". -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture"
4.2.4 4.5.2.B	ERS	5.1.3 Nominal System Setpoints	X	-	X	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied. In addition, qualification analysis provides reasonable assurance that the setpoint analysis requirement (from the EPRI TR) is satisfied.	X	Unit Model Numbers Configuration Identifications of Units Quality of Design and Manufacture Trip set point of each module Performing correct ac ion upon reaching setpoint	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers," "Configuration Identifications of Units," "Trip set point of each module," and "Performing correct action upon reaching setpoint." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture." Information needed to support an application specific setpoint analysis was planned to be provided in the setpoint support analysis.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by						Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification	Post-Qualification Activities						
4.2.1.A 4.3.4.1 4.3.4.3.F	ERS	5.1.3.1 Response Time Requirements	X	-	-	X	-	-	Qualification testing provides reasonable assurance that the total system response ime requirement (from the ERS) is satisfied. CGI procurement acceptance includes activity to reasonably assure that all other ERS response time requirements (except total system response ime) are satisfied.	X	Unit Model Numbers Configuration Identifications of Units Quality of Design and Manufacture Total system response time for trip signal	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers" and "Configuration Identifications of Units." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture." "Total system response time for trip signal" was confirmed during the equipment qualification test.
4.3.2.1.2.B	ERS	5.1.4 Drift and Accuracy Requirements	X	-	X	X	-	-	CGI procurement acceptance includes activity to reasonably assure that this performance/design requirement is satisfied. Qualification testing provides reasonable assurance that the linearity requirement (from the EPRI TR) is satisfied. Qualification analysis will address he drift analysis requirement and overall accuracy requirement (from the EPRI TR).	X	Unit Model Numbers Configuration Identifications of Units Quality of Design and Manufacture Accuracy of APRM Upscale (High-High) trip/reset Accuracy of Simulated Thermal Power Upscale trip/reset	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers," "Configuration Identifications of Units," "Accuracy of APRM Upscale (High-High) trip/reset," and "Accuracy of Simulated Thermal Power Upscale trip/reset." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture."

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.9.2	ERS	5.1.5 Instrument Modes	X	-	-	X	-	-	CGI procurement acceptance includes activity to reasonably assure that this performance/design requirement is satisfied. Qualification testing provides reasonable assurance that the mode function requirement (from the ERS) is satisfied.	X	Unit Model Numbers Configuration Identifications of Units Quality of Design and Manufacture Change of state of signal when mode is changed	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers" and "Configuration Identifications of Units". -Commercial Grade Survey (Method 2) is identified as acceptance method for "Quality of Design and Manufacture" "Total system response time for trip signal" was planned to be confirmed during the qualification test.
4.2.3.6 4.2.3.7.A 4.3.4.7.B 4.3.4.7.C 4.4.1.2.G 4.4.6.1 4.4.6.1.1 4.4.6.1.5 4.4.6.1.8 4.4.6.1.9 4.4.6.1.10 4.4.6.1.11 4.4.6.1.12 4.4.6.1.13 4.4.6.1.14	ERS	5.1.6 Failure Detection and Self Test Requirements	X	-	-	X	-	-	CGI procurement acceptance includes activity to reasonably assure that this performance/design requirement is satisfied. Qualification Testing provides reasonable assurance that the requirements are met.	X	Unit Model Numbers Configuration Identifications of Units Quality of Design and Manufacture Fault condition signal generated during faults	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers," "Configuration Identifications of Units," and "Self Test Functions and Surveillance Testing Capability for Modules." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture." The failure detection and self test functions were planned to be confirmed during the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.2.3.2 4.2.3.3 4.2.3.4 4.2.3.5 6.4.1	ERS	5.1.7 Availability/Reliability Requirements	X	-	X	-	-	-	CGI procurement acceptance includes activity to reasonably assure that the MTBF requirement is satisfied. Qualification analysis will address he availability/reliability analysis requirement (from the EPRI TR).	X	Unit Model Numbers Quality of Design and Manufacture	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture." The availability/reliability requirement described in the ERS Section 5.1.7 was planned to be confirmed in the availability/reliability analysis.
4.3.1.4 4.3.2.1	ERS	5 2.1 Unit Configuration Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Configuration Identifications of Units	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Configuration Identifica ions of Units".
ERS4.3.1 ERS4.4.1 ERS4.1.2 ERS4.1.3 ERS4.2 ERS4.5	ERS	5 2.2 Unit Input/Output Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Unit Model Numbers Configuration Identifications of Units	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers" and "Configuration Identifications of Units."

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.3.2.1.C 4.3.2.1.D 4.3.2.1.E 4.3.2.1.2.A 4.3.2.1.2.C 4.3.2.1.2.D 4.3.2.1.2.E 4.3.2.1.2.J 4.3.2.2 4.3.2.2.2.A 4.3.2.2.2.B 4.3.2.2.2.C 4.3.2.2.2.D 4.3.3.1 4.3.3.1.B 4.3.3.1.1.A 4.3.3.1.1.B 4.3.3.1.1.C 4.3.3.1.1.D 4.3.3.2 4.3.3.2.A 4.3.3.2.B 4.3.3.2.C 4.3.3.2.2.A 4.3.3.2.2.B 4.3.3.2.2.C 4.3.3.2.2.D 4.3.3.2.2.E 4.3.3.2.2.G 4.4.1.2.A	ERS	5 2.3 Module Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Configuration Identifications of Units -- Module Model Numbers -- Revision Number -- Serial Number Module Documentation Output Linearity APRM Inoperable Trip Accuracy of Trip/Reset LVPS Power output Display Linearity for Modules	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Configuration Identifications of Units," "Module Documentation," "Accuracy," and "LVPS Power output."

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by						Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification	Post-Qualification Activities						
4.3.4.6	ERS	5 2.4.1 Chassis Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Quality of Design and Manufacture Chassis structure Chassis type, dimensions Weight	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as acceptance method for "Chassis structure" and "Chassis type, dimensions, weight." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture"
4.6.5	ERS	5 2.4.2 System Cables and Connectors	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Quality of Design and Manufacture Cable Type and length Connecter Type	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Cable Type and length", and "Connector Type." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture."
4.3.4.2	ERS	5 2.4.3 Data Retention Capability Requirements.	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	FPGA type ROM type	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "FPGA Type" and "ROM Type."

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.3.4.3	ERS	5 2.4.4 Transferring information between modules and modules	X	-	-	X	-	-	Procurement of the CGI, with special requirements for loss of power to chassis interconnect, provide reasonable assurance that transfer requirements are satisfied. Qualification testing provides reasonable assurance that the requirements are met.	X	Unit Model Numbers Quality of Design and Manufacture	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following methods: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers." -Commercial Grade Survey (Method 2) is identified as acceptance method for "Quality of Design and Manufacture." Transferring informa ion in the same unit was also planned to be confirmed during the qualification test.
4.6.8	ERS	5 2.4.5 Grounding/Shielding Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Unit Model Numbers Provision of Grounding Points Provision of Shielding Points	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses the following method: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers", "Provision of Grounding Points," and "Provision of Shielding Points."
4.6.6	ERS	5 2.4.6 Termination Requirements	X	-	-	X	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied. Qualification testing provides reasonable assurance that the requirements are met.	X	Unit Model Numbers Connector type	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers" and "Connector type". Termination features were also planned to be confirmed during the qualification test by conducting operability test.
	ERS	5 2.4.7 Requirement for Power Supply line	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Varistor Type Number Noise Filter Type Number	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as the acceptance method for "Varistor Type Number" and "Noise Filter Type Number."

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EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.2.2 4.4.5.2.E 7.2.G 7.4 7.5,2 7.5.3 7.7.3 8.7.E	ERS	5 3 Software Requirements	X	-	-	-	X	-	Software qualification by NED provides reasonable assurance that the requirement is satisfied. Procurement of the CGI provides reasonable assurance that the requirements are satisfied, including providing necessary V&V information from vendor.	X	Quality of Design and Manufacture Documentation that work is performed in accordance with a program that has: -- Lifecycle V&V requirements (documents such as FE specs, FPGA design specs, implementation records, testing records, etc.) -- Traceability Requirements (of the boards, etc.) -- Document and Coding Control Requirements -- Configuration Control requirements -- Change Control Requirements -- Design Language and Tool Control Requirements -- Labelling requirements for logic revision number on chips Design Requirements -- Synchronous design -- Modular design using completely tested FEs -- Lengths of train of the FEs FPGA model number (for size, non-rewritable, retention capability)	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture" in the Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1). The software requirements described in ERS Section 5.3 was planned to be confirmed through the V&V activi ies.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.7.8.2	ERS	5.4 Design Life	X	-	-	X	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied, including providing modular design, bypass capability and redundancy within the units. Qualification testing provides reasonable assurance that the requirements are met.	X	Unit Model Numbers Quality of Design and Manufacture	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following methods: -Source verification (Method 3) is identified as the acceptance method for "Unit Model Numbers." -Commercial Grade Survey (Method 2) is identified as the acceptance method for "Quality of Design and Manufacture" The design life was planned to be considered into the condition of the qualification test.
4.3.6.1 4.3.6.2 4.3.6.3	ERS	5 5.1 Environmental Requirements	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the environmental requirements are met.	-	-	Qualification Test	at Qualification Test	Environmental tes ing in accordance with the ERS Section 5.5.1 was planned to be conducted in the qualification test.
4.3.9	ERS	5 5.2 Seismic Requirements	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the seismic requirements are met.	-	-	Qualification Test	at Qualification Test	Seismic testing in accordance with the ERS Section 5.5.2 was planned to be conducted in the qualification test.
4.3.7	ERS	5 5.3 EMI/RFI Requirements	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Seismic testing in accordance with the ERS Section 5.5.3 was planned to be conducted in the qualification test.
4.6.2	ERS	5 5.4 Surge Withstand Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Surge withstand testing in accordance with the ERS Sec ion 5.5.4 was planned to be conducted in the qualification test.
4.6.2	ERS	5 5.5 ETF/B Withstand Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	EFT/B withstand testing in accordance with the ERS Sec ion 5.5.5 was planned to be conducted in the equipment qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification	Post-Qualification Activities						
4.3.8	ERS	5 5.6 ESD Withstand Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	ESD withstand testing in accordance with the ERS Sec ion 5.5.6 was planned to be conducted in the equipment qualification test.
4.6.4	ERS	5 5.7 Isolation Requirement	X	-	-	X	-	-	Procurement for CGI ensures hat vendor provides items that NED has selected based on the requirements. Qualification testing provides reasonable assurance that the requirements are met.	X	Unit Model Numbers Configuration Identification of Units Quality of design and manufacture	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following methods: -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers" and "Configuration Identification of Units". -Commercial Grade Survey (Method 2) is identified as acceptance method for "Quality of Design and Manufacture" Isolation testing in accordance with the ERS Section 5.5.7 was planned to be conducted in the qualification test.
4.3.1.4 4.3.4.7 A 4.6.1.1.D 4.6.1.1.F 4.6.1.1.I 4.3.4.7.D 4.6.1.1 A	ERS	5 5.8 Power Supply	X	-	-	X	-	-	Procurement for CGI ensures hat vendor provides items that NED has selected based on the requirements. Qualification testing provides reasonable assurance that the requirements are met.	X	Unit Model Numbers Configuration Identification of Units Quality of Design and Manufacture	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1): -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers" and "Configuration Identification of Units". -Commercial Grade Survey (Method 2) is identified as acceptance method for "Quality of Design and Manufacture" The qualification test was planned to be conducted under the power supply condition required in the ERS Section 5.5.8.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by						Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification	Post-Qualification Activities						
7.2.A	ERS	5.6 Classifica ion	X	X	X	X	X	-	The ERS contains requirements hroughout which invoke the Appendix B QA program. There are many CCs specific to this ERS requirement.	(See many other sections)	(See many other sections)	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	Because ERS Section 5.6 contains requirements which invoke the Appendix B QA program, CCs which require the Appendix B QA program are required to be CCAs for CGD in order to satisfy this ERS requirement.
4.7.3 4.7.5 4.7.8.1	ERS	5 8 Maintenance Requirements	X	-	X	-	-	-	Procurement for CGI ensures hat vendor provides items that NED has selected based on the requirements. Qualification analyses will provide reasonable assurance that the MTBF requirement is met.	X	Unit Model Numbers Quality of Design and Manufacture	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1): -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers". -Commercial Grade Survey (Method 2) is identified as acceptance method for "Quality of Design and Manufacture" Availability/reliability analysis was planned to be provided in the qualification analyses.
7.2.A	ERS	5 9 Design Method	X	-	-	-	X	-	Software qualification by NED provides reasonable assurance that the requirement is satisfied. Procurement of the CGI provides reasonable assurance that the requirements are satisfied, including providing necessary V&V information from vendor.	(See many other sections)	(See many other sections)	Acceptance Method	Recurring	EXCEPTION: This item is covered in many other sections in the Appendix A of the PRM PTER.
4.9.4	ERS	5.10 Material Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	-	-	-	-	Because no hazardous materials were used in the PRM system, no Critical Characteristics for Acceptance (CCA) for CG Items are required.

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.8	ERS	5.11 Requirements for Third Party/Sub-Vendor Items	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	-	-	-	-	EXCEPTION: Because this CC was confirmed by the all Critical Characteristics for Acceptance (CCA) for CG Items identified in the Appendix A of the PRM PTER, no specific CCA for CGI is shown in the column L.
7.2.A	ERS	6 Fabrication Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	(See many other sections)	(See many other sections)	-	-	EXCEPTION: Because the ERS Section 6 contains requirements throughout the ERS. There are many CCs specific to this ERS requirement. So, in column L, CCAs for CGI identified for many other ERS sections are referred as CCA for CGI for this ERS requirement.
5.2.A	ERS	7.1 Unit and Module tests	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Documentation	-	-	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1): -Source verification (Method 3) is identified as acceptance method for "Documentation".
5.2.B 5.2.C 5.2.D 5.2.E 5.2.F	ERS	7 2.1 System tests	X	X	-	X	X	-	The requirement is satisfied by NED's acceptance activity for CGI. The procurement for CG services provides associated services for performing the test such as wiring design of test system and Test Equipment. Qualification testing provides reasonable assurance that the requirements are met. System validation tests are performed in software qualification activi ies.	(See many other sections)	(See many other sections)	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	EXCEPTION: Because the ERS Section 7.2.1 contains requirements throughout the ERS. There are many CCs specific to this ERS requirement. So, in column L, CCAs for CGI identified for many other ERS sections are referred as CCA for CGI for this ERS requirement. The qualification testing and system validation testing in software qualification were planned to be conducted in accordance with the requirement of the ERS Section 7.2.1.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
5.3	ERS	7 2.2 Operability Test Requirements	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. The procurement for CG services provides wiring design of test system and Test Equipment.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, type of relay applied to the trip auxiliary unit as test equipment is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.1 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), Source Verifica ion (Method 3) is identified as acceptance method for the type of relay described in Section 4.3.4.1 of main body of the PTER. The operability test requirements described in ERS 7.2.2 was also planned to be confirmed during the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
5.4	ERS	7 2.3 Prudency Testing Requirements	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. The procurement for CG services provides wiring design of test system and Test Equipment.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, type of relay applied to the trip auxiliary unit as test equipment is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.1 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), Source Verifica ion (Method 3) is identified as acceptance method for the type of relay described in Section 4.3.4.1 of main body of the PTER. The prudency test requirements described in ERS 7.2.3 was also planned to be confirmed during the qualification test.
5.5	ERS	7 2.4 Operability and Prudency Tests Applicability	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Operability and prudency tests in accordance with the ERS Section 7.2.4 was planned to be conducted in he qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.2.1.A 6.2.1.B 6.2.1.C 6.2.1.D 6.2.1.E 6.2.1.F 6.2.1.G 6.2.1.H 6.2.1.I 6.2.1.1	ERS	7 3.1.1 Test specimen Hardware Configuration and Arrangement Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Unit Model Numbers Configuration Identification of Units	-	-	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers" and "Configuration Identifications of Units".
6.2.2.	ERS	7 3.1.2 Test Specimen Software Requirements	X	-	-	-	-	-	Procurement of the CGI provides reasonable assurance that the requirements are satisfied.	X	Unit Model Numbers Configuration Identification of Units	-	-	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as acceptance method for "Unit Model Numbers" and "Configuration Identifications of Units".

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.2.3	ERS	7 3.1.3 Test Support Equipment Requirements	-	X	-	X	-	-	Procurement for CG services provides reasonable assurance that the requirements are met. Control of test equipment is part of the qualification testing scope.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, type of relay applied to the trip auxiliary unit as test equipment is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.1 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), Source Verifica ion (Method 3) is identified as acceptance method for the type of relay described in Section 4.3.4.1 of main body of the PTER. The test support equipment requirements described in ERS 7.3.1.3 was also planned to be confirmed during the qualification test.
6.3	ERS	7 3.2 Qualification Tests and Analysis requirements	-	-	-	X	-	-	Qualification testing shall provide reasonable assurance that testing will meet the ERS requirements.	-	(See ERS Section 5.1.3 for setpoint CCs)	Qualification Test	at Qualification Test	The setpoint values required in ERS Section 7.3.2 were planned to be verified in the qualification test.
6.3.1	ERS	7 3.2.1 Aging Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Aging factor in accordance with the ERS Section 7.3.2.1 were planned to be considered in the qualifica ion test.

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.3.2	ERS	7 3.2.2 EMI/RFI Test Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	EMI/RFI testing in accordance with the ERS Section 7.3.2.2 was planned to be conducted in the qualification test.
6.3.2.1	ERS	7 3.2.3 EMI/RFI Test Mounting Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, grounding requirement for the test equipment rack is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.9 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Allows Grounding of the Test Specimen" described in Section 4.3.4.9 of main body of the PTER. The EMI/RFI test mounting requirement described in ERS 7 3.2.3 was also planned to be confirmed during the qualification test.
6.3.3	ERS	7 3.2.4 Environmental Test Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	EMI/RFI testing in accordance with the ERS Section 7.3.2.4 was planned to be conducted in the qualification test.

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification	Post-Qualification Activities						
6.3.3.1	ERS	7 3.2.4.1 Environmental Test Mounting Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, requirements for the test equipment rack structure related to the environmental test are provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.9 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Non-Enclosure of Chassis" described in Section 4.3.4.9 of main body of the PTER. The environmental test mounting requirement described in ERS 7.3.2.4.1 was also planned to be confirmed during the qualification test.
6.3.4	ERS	7 3.2.5 Seismic Test Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Seismic testing in accordance with the ERS Section 7.3.2.5 was planned to be conducted in the qualification test.

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.3.4.1	ERS	7 3.2.5.1 Seismic Test Mounting Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	Seismic testing in accordance with the ERS Section 7.3.2.5.1 was planned to be conducted in the qualification test.
6.3.4.2	ERS	7 3.2.6 Seismic Test Measurement Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Seismic testing in accordance with the ERS Section 7.3.2.6 was planned to be conducted in the qualification test.
6.3.4.3	ERS	7 3.2.6.1 Seismic Test Performance Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Seismic testing in accordance with the ERS Section 7.3.2.6.1 was planned to be conducted in the qualification test.
6.3.4.4	ERS	7 3.2.6.2 Seismic Test Spectrum Analysis Requirement	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Seismic testing in accordance with the ERS Section 7.3.2.6.2 was planned to be conducted in the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.3.5	ERS	7 3.2.7 Surge Withstand Capability Test Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, requirements for the test equipment rack structure related to the surge withstand capability test are provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.9 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Does not prevent exposure of noise on test specimen" described in Section 4.3.4.9 of main body of the PTER. The surge withstand capability requirement described in ERS 7 3.2.7 was also planned to be confirmed during the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.3.6	ERS	7 3.2.8 Class 1E to Non-1E Isolation Test Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, requirements for the test equipment rack structure related to the class 1E to Non-1E isolation test are provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.9 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Non-Enclosure of Chassis" and "Does not prevent exposure of noise on test specimen" described in Section 4.3.4.9 of main body of the PTER. The class 1E to Non-1E isolation test requirement described in ERS 7.3.2.8 was also planned to be confirmed during the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
-	ERS	7 3.2.9 EFT/B Test Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, requirements for the test equipment rack structure related to the EFT/B test are provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.9 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Non-Enclosure of Chassis" and "Does not prevent exposure of noise on test specimen" described in Section 4.3.4.9 of main body of the PTER. The class 1E to Non-1E isolation test requirement described in ERS 7.3.2.8 was also planned to be confirmed during the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
EPRI TR-107330 CTM ITEM NO.	Document	SECTION of ERS or PQAM	ERS/PQAM Requirement to be confirmed by					Post-Qualification Activities	Remarks on selection of Methods for Ensuring ERS/PQAM requirements are satisfied	CCDs for CGI	CCAs for CGI	Applicable Method to Confirm Critical Characteristics (Acceptance Method and/or Qualification Test)	Required Frequency for Applying Acceptance Method	Explanation for this Entry
			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.4.2	ERS	7 3.2.10 ESD Test Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, grounding requirement for the test equipment rack is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.9 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Allows Grounding of the Test Specimen" described in Section 4.3.4.9 of main body of the PTER. The ESD test requirement described in ERS 7.3.2.10 was also planned to be confirmed during the qualification test.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
6.4.3	ERS	7 3.2.11 Power Quality Tolerance Requirement	-	X	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met. Procurement for CG services provides reasonable assurance that Test Equipment meets the requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, requirements for power supply are provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.4.7 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4.3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), special test and inspections (Method 1) is identified as acceptance me hod for "Power Supply Provision for System Integration Test" described in Section 4.3.4.7 of main body of the PTER. The ESD test requirement described in ERS 7.3.2.11 was also planned to be confirmed during the qualification test.
6.4.4	ERS	7 3.3 Requirements for Compliance to Specifications	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Qualification tests were planned to be conducted in accordance with the ERS Section 7.3.3 requirement.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.10.1 A 4.10.1.B 4.10.1.C 4.10.1.D 4.10.1.E 4.10.1.F 4.10.1.G 4.10.1.H 4.10.1.J	ERS	8.1 Packaging Requirements	-	X	-	X	-	-	Procurement for CG services provides reasonable assurance that the packing for shipment to Wyle is in accordance with the requirements. Qualification testing requirements provide reasonable assurance that the packaging by Wyle will be in accordance with these requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, quality of packaging is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.3.6 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for "Quality of Packaging" described in Section 4.3.3.6 of main body of the PTER. The quality of packaging was also planned to be indirectly confirmed through the qualification test.
4.10.2	ERS	8 2 Shipping Requirements	-	X	-	X	-	-	Procurement for CG services provides applicable shipping requirements for Test Specimen. Qualification testing requirements provide reasonable assurance that shipping by NED to and from Wyle, and by Wyle within the US, will be in accordance with these requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCs identified in ERS Section 8.2. For example, in the Acceptance Plan for the Transportation Service (FPG-PLN-C51-0022 Rev.1), source verification is identified as acceptance method for "type of vehicles used for the transportation". The quality of packaging was also planned to be indirectly confirmed through the qualification test.

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
4.10.3	ERS	8 3 Storage Requirements	-	X	-	X	-	-	Procurement for CG services provides applicable storage requirements for Test Specimen. Qualification testing requirements provide reasonable assurance that the storage will be in accordance with these requirements.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, quality of storage is provided as Critical Characteristics for Acceptance (CCA) in Section 4.3.3.6 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), Commercial Grade Survey (Method 2) and Source Verification (Method 3) are identified as acceptance method for "Quality of Storage" described in Section 4.3.3.6 of main body of the PTER. The quality of packaging was also planned to be indirectly confirmed through the qualification test.
8.1.A 8.1.D 8.1.E 8.1.F 8.1.G	ERS	9.1.1 Equipment General Overview Documentation	X	-	-	-	-	-	Procurement for CGI provides reasonable assurance that the requirements are met.	X	Documentation	-	-	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as acceptance method for "Documentation".
4.7.3 4.7.4 4.7.9.B 4.7.9.C 8.3 8.5	ERS	9.1.3 Users Manual	X	-	-	-	-	-	Procurement for CGI provides reasonable assurance that the requirements are met.	X	Documentation	-	-	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as acceptance method for "Documentation".

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
8.6.1.A 8.6.5	ERS	9 2.1 Programmatic Documentation A.	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Toshiba planned to conduct qualification tests in accordance with the Master Test Plan which satisfies ERS Section 9.2.1 A requirements.
8.6.1.B 8.6.1.C	ERS	9 2.1 Programmatic Documentation B.	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Qualification tests were planned to be conducted in accordance with test procedures that satisfy ERS Section 9.2.1 B requirements.
8.6.1.D	ERS	9 2.1 Programmatic Documentation C.	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	Toshiba planned to generate a qualification test summary report in accordance with the ERS Section 9.2.1 C requirement.
8.6.1.E	ERS	9 2.1 Programmatic Documentation D.	X	X	-	X	X	-	Audits will be performed during CGI, CGS, testing (and to approve Wyle), FPGA development (per the SQAP), and of third parties. These activities provide reasonable assurance that the audit requirements will be satisfied.	-	-	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	Toshiba planned to generate audit reports in accordance with the ERS Section 9.2.1 D requirement.
8.6.1.F	ERS	9 2.1 Programmatic Documentation E.	-	-	X	-	-	-	Qualification analyses provide reasonable assurance that the requirements are met.	-	-	-	-	Availability/reliability analysis, setpoint support analysis, and FMEA were planned to be conducted in the qualification analysis.

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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
8.6.2.A 8.6.2.B 8.6.2.D	ERS	9 2.2 Technical Items	X	-	-	-	-	-	Procurement for CGI provides reasonable assurance that the requirements are met.	X	-	-	-	EXCEPTION: Because the ERS Section 9.2.2 contains requirements throughout the ERS. There are many CCs specific to this ERS requirement. So, in column L, CCAs for CGI identified for many other ERS sections are referred as CCA for CGI for this ERS requirement.
8.6.3. 8.6.3.A 8.6.3.B 8.6.3.C 8.6.3.D 8.6.3.E 8.6.3.F 8.6.3.H 8.6.3.J 8.6.3.K 8.6.3.L 8.6.3.M 8.6.3.N 8.6.3.O 8.6.3.P 8.6.3.Q 8.6.3.R 8.6.3.S 8.6.3.T	ERS	9 2.3 Application Guide.	-	-	-	-	-	X	After all qualification activities, NED performs this activity.	-	-	-	-	Column I shows that an application guide was planned to be documented in post qualification activities in accordance with. ERS Section 9.2.3 requirements.
8.6.4	ERS	9 2.4 Supporting Analyses Documentation	-	-	X	-	-	-	Qualification analyses provide reasonable assurance that the requirements are met.	-	-	-	-	Availability/reliability analysis and FMEA for PRM system were planned to be provided in accordance with ERS Section 9.2.4 requirements.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
8.7.B 8.7.C	ERS	9 2.5 V&V Documentation	X	-	-	-	X	-	Procurement of CGI provides required documents to be prepared by Fuchu-IP. Software qualification provides required documents to be prepared by NED.	X	Documentation	Acceptance Method	Recurring	The Acceptance Plan for Test Specimen Units, Interconnecting Cables (FPG-PLN-C51-0008 Rev.1) uses following method: -Source verification (Method 3) is identified as acceptance method for "Documentation". V&V documents were also planned to be documented in accordance with ERS Section 9.2.5 requirements.
8.8	ERS	9 2.6 Test System Description	-	-	-	-	-	-	This information is covered by ERS section 9.2.3; software design description does not apply, since the PRM system does not have programmable software. The hardware description of ERS 9.2.3 will be sufficient.	-	-	-	-	EXCEPTION: This requirement is covered by ERS sec ion 9.2.3; software design descrip ion does not apply, since the PRM system does not have programmable software. The requirement was planned to be confirmed by the CCs for ERS 9.2.3.
8.9	ERS	9 2.7 Critical Characteristics	-	-	-	-	-	-	The PTER provides required information.	-	-	-	-	EXCEPTION: The information required in ERS Sec ion 9.2.7 was planned to be provided in the PRM PTER.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
8.10.A 8.10.B 8.10.D 8.10.E 8.10.F	ERS	9 2.8 Test System Drawing	-	X	-	-	-	-	Procurement of CG service provides required documents.	-	-	Acceptance Method	Recurring	In Sections 4.3.3 and 4.3.4 of main body of the PTER, Critical Characteristics for Acceptance (CCA) of the CG Services are described. For example, compliance wi h system design specified in PTER Section 4.3.2 is provided as Critical Characteristics for Acceptance (CCA) for the ECWD in Section 4.3.3.1 of main body of the PTER. An acceptance plan was prepared as separate document. The acceptance plan identifies acceptance method to the CCA identified in Sections 4 3.3 and 4.3.4 of main body of the PTER. For example, in the Acceptance Plan for Test Support Services (FPG-PLN-C51-0010 Rev.5), document review is identified as acceptance method for the compliance with system design specified in PTER Section 4.3.2.
8.11	ERS	9 2.9 System Software/Hard ware Configuration Document	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	The system/hardware configura ion during the qualification test was planned to be confirmed by the Master Configuration List for PRM.
8.13	ERS	9 2.10 System Setup/Calibrati on/Checkout Procedure	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	System setup and checkout test procedure for qualification test was planned to be documented in accordance with ERS 9.2.10 requirements.
8.14 8.6.2.E	ERS	9 2.11 System Test Documentation	-	-	-	X	-	-	Qualification testing provides reasonable assurance that the requirements are met.	-	-	Qualification Test	at Qualification Test	System validation plan and report was planned to be documented in the qualification tests (System validation was considered as part of the qualification test).

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
7.2.F	PQAM	6.4 Critical Digital Review	-	-	-	-	X	-	Software qualification by NED provides reasonable assurance that the requirement is satisfied	-	-	Acceptance Method	Recurring	The critical digital review described in the Project Quality Assurance Manual (PQAM) (FPG-PLN-A70-0001) Section 6.4 was planned to be implemented for NICSD and Actel.
6.5.D	PQAM	6 3 Commercial Grade Dedication (CGD)		-	-	-	-	-	NED prepares PTER. NED performed CG Survey. Procurement for CGI provides reasonable assurance that the requirements are met.	(See many other sections)	(See many other sections)	-	-	Because the PQAM Section 6.3 contains many requirements for CGD, there are many CCs associated with this PQAM requirement. The requirements are covered in many other sections dealing with the "Procurement of the CG Items" and "Procurement of CG Services".
6.5.B (1) 7.2.D	PQAM	9 Control of Purchased Material, Equipment, and Services	X	X	-	-	-	-	Procurement of CG items provides reasonable assurance that procurement QA requirements are satisfied.	(See many other sections)	(See many other sections)	-	-	EXCEPTION: Because the PQAM Section 9 contains many requirements related to the procurement of item and services, there are many CCs to these PQAM requirements. So, in column L, CCAs for CGI identified for many o her sections in this Appendix A related to the "Procurement of the CG Items" and "Procurement of CG Services" are referred as CCA for CGI for this PQAM requirements.
6.5.D 7.2.H	PQAM	13.3 Qualification Testing	-	-	-	X	-	-	NED will perform the qualification testing, which provides reasonable assurance that the requirement for test QA and witnessing are met.	-	-	Qualification Test	at Qualification Test	Qualification testing was planned to be conducted in accordance with the PQAM 13.3 requirements.

A	B	C	D	E	F	G	H	I	J	K	L	M	M	P
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			Procurement of CG Items	Procurement of CG Services	Qualification Analyses	Qualification Tests	Software Qualification							
7.3 7.8	PQAM	16 Nonconforming Materials, Parts or Components	X	X	X	X	X	-	CG procurement requirements for problem reporting provide reasonable assurance that problem reporting requirements are met. Work under the NED QA program provides reasonable assurance that problem reporting requirements are met.	-	None.	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	Nonconformance reports were planned to be documented in accordance with the PQAM Section 16 requirements through the all activities in the PRM qualifica ion.
6.4.4.H 7.2.E 7.2.F 8.15	PQAM	19 Reviews, Audits and Surveillance	X	X	-	X	X	-	This requirement is met by the following activities: -- CG survey of Fuchu-IP -- App B Audit of Wyle -- In-process audits of Fuchu-IP (Job Order will state requirement that NQAD shall have access to Fuchu-IP for audits)	-	None.	Acceptance Method Qualification Test	Recurring (Acceptance Method) at Qualification Test (Qualification Test)	Columns B and C show that the requirements for reviews, audits, and surveillance described in the Project Quality Assurance Manual (PQAM) (FPG-PLN-A70-0001) Section 19 verify that Fuchu-IP is performing in accordance with the software lifecycle, which confirms the design aspects of these Critical Characteris ics (CCs). Column A provides the sections of EPRI TR-107330 that are related to the requirements described in PQAM Section 19. The "X" marks in Columns D to H mean that the CCs were confirmed by the acceptance process of "Procurement of CG Items", "Procurement of CG Services", "Qualification Tests", and "Software Qualification". Audits were planned to be conducted in accordance with the PQAM Section 19 requirements.

Attachment 3 Use of Rotary Switches

No	Unit	Module	Switch Name referenced in Documents	Location of the Description in Documents	Function (informative)
1	OPRM	CELL	SELECT OUTPUT CH	Figures 3.1 and 6.1.3.2 Section 6.1.3 of CELL MDS*	The 2-digit rotary switches (described as "digital switch") select one channel to be output to external equipment through the AO module. The selected CELCFIL FPGA's channel data corresponds directly to an LPRM detector. For the selected channel, pre-filtered and post-filtered data are output as two separate voltages.
2	OPRM	CELL	LPRM Lower-limit	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1, Section 11.1 of CELL MDS	The 3-digit rotary switches (described as "digital switch") set the lower-limit of the LPRM. Any LPRM level below this limit is ignored. The switches set the percent power, as XX.X%.
3	OPRM	CELL	Conditioning Filter Cut-off Frequency	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1, Section 11.2 of CELL MDS	The 4-digit rotary switches (described as "digital switch") set the Conditioning filter cutoff frequency in Hertz (Hz). The switches set the frequency as X.XXX Hz.
4	OPRM	CELL	Minimum Number of Active OPRM Cells	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1, Section 11.3 of CELL MDS	The 2-digit rotary switches (described as "digital switch") set the minimum number of active cells required for the OPRM to be functional.
5	OPRM	CELL	OPRM Region APRM Level	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1, Section 11.4 of CELL MDS	The 3-digit rotary switches (described as "digital switch") set the APRM level that set the percent power limit that arms the OPRM. If the APRM level becomes smaller than this value, the OPRM is automatically bypassed. If either power or flow is not within the instability region of the power-flow map, the OPRM is bypassed. The switches set the percent power, as XX.X%.

No	Unit	Module	Switch Name referenced in Documents	Location of the Description in Documents	Function (informative)
6	OPRM	CELL	OPRM Region Core Flow Level	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1, Section 11.5 of CELL MDS	The 3-digit rotary switches (described as "digital switch") set the percent flow (ABWR Core Flow) that arms the OPRM. If the flow level becomes larger than this value, the OPRM is automatically bypassed. If either power or flow is not within the instability region of the power-flow map, the OPRM is bypassed. The switches set the percent power, as XX.X%.
7	OPRM	CELL	OPRM Region APRM Level Hysteresis	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1, Section 11.6 of CELL MDS	The 1-digit rotary switch sets the hysteresis percent value for exiting from the OPRM region, applied to the percent APRM power level. The switch sets the percent power, as X%
8	OPRM	CELL	OPRM Region Core Flow Level Hysteresis	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1 Section 11.7 of CELL MDS	The 1-digit rotary switch sets the hysteresis percent value for exiting from the OPRM region, applied to the percent Core Flow level. The switch sets the percent power, as X%
9	OPRM	CELL	Minimum Number of Active LPRMs	Table 4.1.2-1 of OPRM Unit User's Manual Figures 3.1 and 6.1.8.1 Section 11.8 of CELL MDS	The 1-digit rotary switch sets the minimum number of active LPRMs required for an active OPRM CELL. If the number of active LPRMs in a Cell is less than this value, the OPRM cell is marked as inactive. The switch sets a value between 1 and 3.
10	OPRM	AGRD	Threshold	Table 4.1.2-2 of OPRM Unit User's Manual Section 6.1.6, Table 6.1.6.1, and Figure 6.1.6.4 of AGRD MDS	The 3-digit rotary switches set the parameter S1 in the Amplitude Based detection (ABA) and Growth Rate Detection (GRA) algorithms. The switches set the S1 value, as X.XX between 1.00 and 1.99.
11	OPRM	AGRD	Minimum Threshold		The 3-digit rotary switches set the parameter S2 in the ABA and GRA algorithms. The switches set the S2 value, as X.XX between 0.50 and 1.99.
12	OPRM	AGRD	Growth Rate Factor		The 3-digit rotary switches set the parameter DR3 in the ABA and GRA algorithms. The switches set the DR3 value, as X.XX between 1.00 and 1.99.

No	Unit	Module	Switch Name referenced in Documents	Location of the Description in Documents	Function (informative)
13	OPRM	AGRD	Time Window for Minimum Threshold		The 3-digit rotary switches set the parameter TI in the ABA and GRA algorithms. The switches set the T1 value, as X.XX second between 0.00 and 0.99 second.
14	OPRM	AGRD	Time Window for Trip Setpoint		The 3-digit rotary switches set the parameter Th in the ABA and GRA algorithms. The switches set the Th value, as X.XX seconds between 0.00 and 9.99 seconds.
15	OPRM	AGRD	ABA and GRA Trip hold time		The 2-digit rotary switches set the trip signal hold time, entered as X.X seconds.
16	OPRM	AGRD	Peak and Valley Detection Width		The 1-digit rotary switch sets a margin parameter to determine a peak or a valley of the normalized oscillation signal, entered as X between 0.001 (inclusive) and 0.010 (exclusive).
17	OPRM	PBD	PBDA Amplitude	Table 4.1.2-3 of OPRM Unit User's Manual Section 6.1.5, Table 6.1.5.1, Figure 6.1.5.3 of PBD MDS	The 3-digit rotary switches set the parameter Sp described in Period Based Detection algorithm (PBDA).
18	OPRM	PBD	Period Minimum		The 3-digit rotary switches set the parameter Tmin described in PBDA.
19	OPRM	PBD	Period Maximum		The 3-digit rotary switches set the parameter Tmax described in PBDA.
20	OPRM	PBD	PBD Trip Hold Time		The 2-digit rotary switches set the trip signal hold time, entered as X.X seconds.
21	OPRM	PBD	Peak and Valley Detection Width		The 1-digit rotary switch sets a margin parameter to determine a peak or a valley of the normalized oscillation signal, entered as X between 0.001(inclusive) and 0.010 (exclusive).
22	LPRM/ APRM	APRM	Filter Time Constant for the APRM level	Section 2.15, Figure 3.5.3 of APRM MDS	The 3-digit rotary switches set the filter time constant for the APRM level used for the APRM level high alarm. The switches set the time constant as X.XX seconds.
23	LPRM/ APRM	APRM	Filter Time Constant for the Simulated Thermal Power level	Section 2.15, Figure 3.4.3 of APRM MDS	The 3-digit rotary switches set the filter time constant for the Simulated Thermal Power level. The switches set the time constant as X.XX seconds.

No	Unit	Module	Switch Name referenced in Documents	Location of the Description in Documents	Function (informative)
24	LPRM/ APRM	APRM	APRM High setpoint (1) Slope (2) Offset (3) Clamp (4) Other-than-run	Section 2.15, Figure 3.7.2 of APRM MDS	The APRM module has the four sets of rotary switches for the flow-biased APRM high setpoint. The first three sets of rotary switches, Slope, Offset, and Clamp give the APRM high setpoint using the following equation: *APRM high setpoint* = Slope × *recirculation flow level* + Offset, in which Clamp limits the maximum value of the APRM high setpoint. The Slope is 3-digit rotary switches, each expressed as X.XX. The Offset and Clamp are 4-digit rotary switches, each expressed as XXX.X%. The last set of switches Other-than-run sets the APRM high setpoint when the reactor mode is other than "Run." The Other-than-run is 3-digit rotary switches, each expressed as XX.X%.
25	LPRM/ APRM	APRM	Simulated Thermal Power High trip setpoint (1) Slope (2) Offset (3) Clamp	Section 2.15, Figure 3.7.2 of APRM MDS	The APRM module has three sets of rotary switches for the flow-biased Simulated Thermal Power high setpoint. The three sets of rotary switches, Slope, Offset, and Clamp give the Simulated Thermal Power high setpoint using the following equation: *Simulated Thermal Power high setpoint* = Slope × *recirculation flow level* + Offset, in which Clamp limits the maximum value of the Simulated Thermal Power high setpoint. The Slope is 3-digit rotary switches, expressed as X.XX. The Offset and Clamp are 4-digit rotary switches, each expressed as XXX.X%.
26	LPRM/ APRM	APRM	APRM High-High trip setpoint (RUN)	Section 2.15, Figure 3.8.3 of APRM MDS	The 4-digit rotary switches set the APRM High-High trip setpoint during the reactor mode is "Run." The trip value is expressed as XXX.X%.

No	Unit	Module	Switch Name referenced in Documents	Location of the Description in Documents	Function (informative)
27	LPRM/ APRM	APRM	APRM High-High trip setpoint (Other than RUN)	Section 2.15, Figure 3.8.3 of APRM MDS	The 3-digit rotary switches set the APRM High-High trip setpoint during the reactor mode is other than "Run." The trip value is expressed as XX.X%.
28	LPRM/ APRM	APRM	APRM Level Downscale	Section 2.15, Figure 3.8.3 of APRM MDS	The 3-digit rotary switches set the APRM downscale limit. The downscale value is expressed as XX.X%.
29	LPRM/ APRM	APRM	Simulated Thermal Power High setpoint (Selected Rod Insertion)	Section 2.15, Figure 3.8.3 of APRM MDS	The 3-digit rotary switches set the Simulated Thermal Power high setpoint used in a select rod insertion. The setpoint value is expressed as XX.X%.
30	LPRM/ APRM	APRM	Flow Low setpoint (Selected Rod Insertion)	Section 2.15, Figure 3.8.3 of APRM MDS	The 3-digit rotary switches set the flow low setpoint used in a selected rod insertion (SRI). The setpoint value is expressed as XX.X%
31	LPRM/ APRM	APRM	Minimum Number of active LPRMs	Section 2.15, Figure 3.8.3 of APRM MDS	The 2-digit rotary switches set the minimum number of active LPRMs required for the APRM to remain operational. The input value is expressed as XX LRPMs.
32	LPRM, LPRM/ APRM	LPRM	LPRM Level High	Section 3.10, Figure 3.10.1 of LPRM MDS	The 4-digit rotary switches set the LPRM level high alarm setpoint. The alarm value is expressed as XXX.X%.
33	LPRM, LPRM/ APRM	LPRM	LPRM Level Downscale	Section 3.10, Figure 3.10.1 of LPRM MDS	The 3-digit rotary switches set the LPRM level downscale alarm limit. The alarm limit is expressed as XX.X%.
34	FLOW	SQ-ROOT	Filter Constant	Section 2.13, Figure 3.4.1 of SQ-ROOT MDS	The 3-digit rotary switches set the filter constant of the first-order lag filter applied to the sensor signal. The time constant can be set between 0.00 and 9.99 seconds.
35	FLOW	SQ-ROOT	Low-cut limit	Section 2.13, Figure 3.6.1 of SQ-ROOT MDS	The 2-digit rotary switches set the low-cut limit of the sensor signal. If the flow level is less than this value, the flow level is set to 0%. The low-cut setpoint can be set between 0 and 40 %.

No	Unit	Module	Switch Name referenced in Documents	Location of the Description in Documents	Function (informative)
36	FLOW	SQ-ROOT	Input Current Error limit	Section 2.13, Figure 3.7.1 of SQ-ROOT MDS	The 2-digit rotary switches set the input current error limit of the sensor signal. If the input current is less than this value, the Input Current Error alarm is generated. The input current error limit can be set between 2.0 and 4.0 mA.
37	FLOW	FLOW	Gain	Section 2.11, Figure 3.2.1 of FLOW MDS	The 4-digit rotary switches set the gain applied to each flow as the flows are summed from the two SQ-ROOT modules. The gain can be set between 0.500 and 2.000.
38	FLOW	FLOW	Flow High	Section 2.11, Figure 3.3.1 of FLOW MDS	The set of 4-digit rotary switches set the Flow high trip setpoint, which is expressed as XXX.X%, between 90.0 and 125.0%.
39	OPRM, LPRM, LPRM/ APRM, FLOW	TRN	Unit ID	Figures 3.1 and 6.1.3.3 Section 11.1 of TRN MDS	The four set of 1-digit rotary switch set the Unit ID for each optical port between 0 and 7.
40	OPRM, LPRM/ APRM	RCV	Unit ID	Figures 3.1 and 6.1.2.1 Section 11.1 of RCV MDS	The four set of 1-digit rotary switches set the Unit ID for each optical port between 0 and 7.