

TOSHIBA

Toshiba Energy Systems & Solutions Corporation

72-34 Horikawa-cho, Saiwai-ku Kawasaki-shi, Kanagawa, 212-8585, Japan

No. TOS-CR-FPG-2019-0002

July 4 2019

NRC Project Number: PROJ0729

Document Control Desk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

99902036

Reference: NRC Fourth Request for Additional Information Regarding the Toshiba License Topical Report "License Topical Report for Toshiba NRW-FPGA-Based Instrumentation and Control System for Safety-Related Application" (TAC NO. ME9861; EPID: L-2012-TOP-0003), dated June 10, 2019

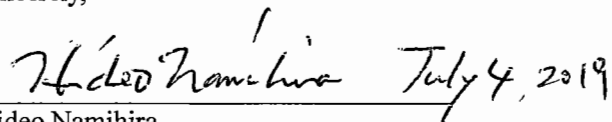
Subject: **Toshiba Response to NRC Fourth RAI (TAC NO. ME9861; EPID: L-2012-TOP-0003)**

Enclosed is the Toshiba Energy System & Solution Corporation's response to the NRC Fourth Request for Information (RAI).

If the NRC has any requests and/or questions, please contact with Jim Powers at 704-548-7910 or by electronic mail at Jim.Powers@toshiba.com.

This letter and the enclosure do not have any proprietary information and can be made public.

Sincerely,

 July 4, 2019

Hideo Namihira
Senior Manager
Electrical System Design & Engineering Dept.
Power Systems Division
Toshiba Energy Systems & Solutions Corporation

T010
NRR

TOSHIBA

Enclosure: E2-2019-000558 Rev.0, Toshiba Response to Fourth RAI

Contact Information:

Mr. Jim Powers
Nuclear Technology Applications
Toshiba America Energy Systems Corporation
3735 Glen Lake Dr., Suite 200, Charlotte, NC 28208
Phone: (704) 548-7910, Facsimile: (704) 548-7701
E-mail: Jim.Powers@toshiba.com

cc:

U. S. Nuclear Regulatory Commission

Joseph Holonich

Toshiba Energy Systems & Solutions Corporation

Akira Fukumoto
Tadashi Miyazaki
Toshifumi Hayashi

Cover letter only
Atsuo Haryu
Yuji Yamamoto

Hogan Lovells US LL

Cover letter only
Daniel F. Stenger

Enclosure – Toshiba Response to Fourth RAI**RAI Dated June 10, 2019****NRC QUESTION 1:**

1. (Open Item 1) Please provide a clear description of Toshiba's updated organization, including roles and responsibilities of the organizations involved in the design, development and testing of the Power Range Monitor (PRM) system and Oscillation PRM unit.

RESPONSE:

Sections I-1.4, I-1.5, and I-A of LTR Part I Rev.2 issued in August 2015 provided the descriptions of the Toshiba organizations responsible for the OPRM and PRM development. Section I-1.4 of the LTR Part I Rev.2 included Figure I-1-1 "Toshiba Organizations for US Safety-Related FPGA-based products" and the Section I-1.5 included Figure I-1-2 "Overview of Process and Organizational Responsibilities"* for the Current Process. Section I-A-1 of LTR Part I Rev.2 described the Original Process with Figure I-A-2*.

As stated in Sections I-1.1 of LTR Part I Rev.2 that explained the Current Process and the Original Process, Toshiba used the Original Process to develop and qualify the PRM for BWR-5, and Toshiba used the Current Process to develop and qualify the OPRM for ABWR. Section I-1.2 of the LTR Part I Rev.2 also stated that the Current Process would be applied to any newly manufactured or modified Toshiba NRW-FPGA-based Safety-Related Systems. Therefore, Toshiba provides Toshiba response to the NRC Question 1 focusing on the Current Process.

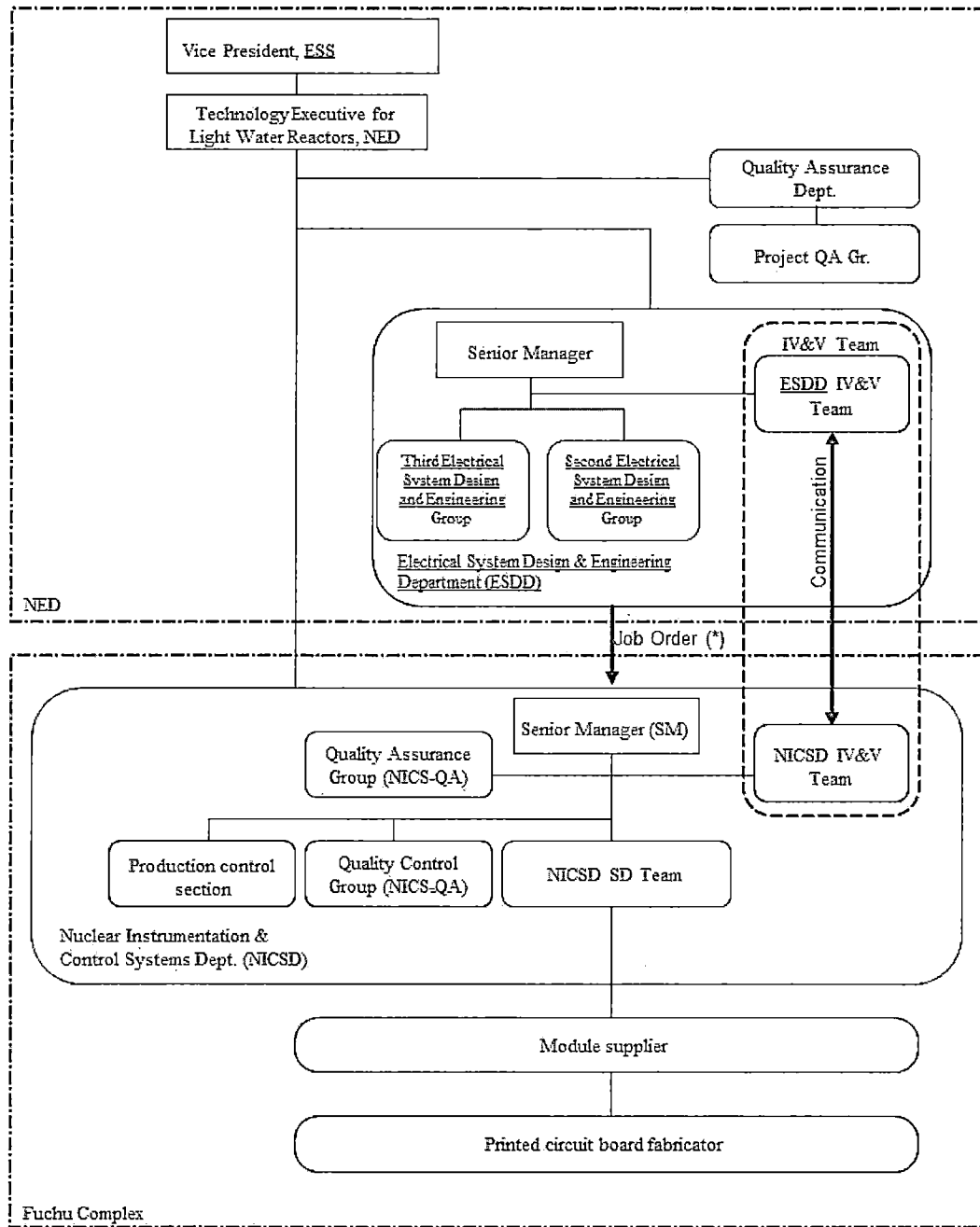
Even though the following organization name changes were made, the roles and responsibilities were not changed.

- ESDD and its Second Electrical System Design and Engineering Group and Third Electrical System Design and Engineering Group had been renamed as such on April 1st, 2015 from ICDD, the Monitoring System Engineering Group and Control System Engineering Group due to department level organization change. The organization structure and the roles and responsibilities of the renamed organizations were kept unchanged. This was addressed in the footnote of Page 10 of LTR Part I Rev.2.

* Note that the term "NQAD" (NED Quality Assurance Department or Nuclear Quality Assurance Department in short) was used in principle to represent the Quality Assurance Department in NED, taking the descriptions of the QAPD (QA Program Description) and QA Manual into account. Allowable exceptions included the Figure I-1-2 and the Figure I-A-2 where the term "Quality Assurance Dept." was used to refer to the same organization.

- On April 1st 2016, Toshiba Corporation Power Systems Company which had NED was renamed as Toshiba Corporation Energy Systems & Solutions Company. Accordingly, Fuchu-PS (Fuchu Power Systems) was renamed as Fuchu-ES (Fuchu Energy Systems) in short. The names of NED, NQAD, ESDD, and NICSD were kept unchanged and the roles and responsibilities of these departments were also kept unchanged. The name “Fuchu Complex” is used when it represents the entire Fuchu site.
- On October 1st 2017, Toshiba Corporation Energy Systems & Solutions Company with its all divisions including NED and Fuchu-ES was established as Toshiba Energy Systems & Solutions Corporation (Toshiba ESS), acting as a subsidiary of Toshiba Corporation. The roles and responsibilities of NQAD and ESDD under NED and NICSD under Fuchu-ES were not changed.

Figure 1 provides the updated figure of Figure I-1-2 of LTR Part I Rev.2 in which above mentioned items were incorporated. The changed parts were underlined.



*) A Job Order is issued from each group in ESDD to NICS.

Figure 1 Updated figure of the associated organizations

Note: On April 1st, 2019, NED merged with another division of Toshiba ESS and changed its name to Power Systems Division. NQAD and NICS were renamed as QAD and Nuclear Systems Control Department respectively. The roles and responsibilities were unchanged and the organization names in the QA program documents have not been changed yet.

NRC QUESTION 2:

2. (Open Item 3) Table 5-5-2 of Toshiba's document FC51-3704-1119, Rev. 0, "Oscillation Power Range Monitoring Requirement Traceability Matrix," includes the following notes:

"The revisions of the module test procedure listed in Table 5-5-2 with the note "*1" were limited to adding the test procedures that are applicable for Japanese domestic plants only."

"The revision of the Module Test Procedure listed in Table 5-5-2 with the note "*2" is limited to incorporating the update of the revision number of the test program which was made after the module testing in this project. The new revision of the test program was not applied to the module testing of this project."

Please answer the following:

- a. Explain the differences between the modules developed for approval in this topical report (i.e. Note 2 items) and those only for Japanese domestic plants (i.e. Note 1 items).
- b. Clarify if the test modules procedures used were the same.
- c. Confirm that the scope of review does not include the modules for Japanese domestic plants (i.e. Note 1 items).

RESPONSE:

- a. Table 5-5-2 of FC51-3704-1119, Rev. 0 shows the revised module test procedures with Notes 1 and 2.

Note 2 item, the DAT/ST module, is used only in the OPRM; it is not used in any Japanese domestic BWRs. The revision number of the test program for the DAT/ST module was updated after the module testing of this project was completed. The DAT/ST Test Procedure was revised to incorporate the update of the revision number of the test program just in case some retesting would be needed, should any problem be found. But any retesting was not required.

Note 1 items, the RCV, TRN, and DIO Module Test Procedures, were prepared for the entire Neutron Monitoring System (NMS) including the systems for Japanese domestic BWRs. These documents are described in both English and Japanese so that the documents can be used both for Japanese domestic BWRs and US BWRs. The RCV, TRN, and DIO modules are commonly used in the PRM and OPRM.

The design of the RCV and TRN modules is the same for Japanese domestic BWRs and US BWRs. However, different model numbers are given to the modules for Japanese domestic BWRs and for US BWRs from the standpoint of configuration management.

As described in Note 3 of Table 5-3-9 of FC51-3704-1119, Rev.0, the DIO module design specification was revised to delete "Constant Voltage Diode." This revision was made after

all the tests of OPRM had been completed. Toshiba did not apply this DIO module, in which “Constant Voltage Diode” was deleted, for the NRC review.

- b. The test procedures for the RCV, TRN, and DIO modules are the same for Japanese domestic BWRs and US BWRs. However, the latest revisions used for the qualification of OPRM in application for the NRC review are different from the revisions used for Japanese domestic plants as stated in Note 1 of Table 5-5-2 of FC51-3704-1119, Rev.0.
- c. The scope of the review does not include the modules (Note 1 items) for the Japanese domestic plants.

NRC QUESTION 3:

- 3. (Open Item 8). Toshiba document FPG-DRT-C51-0027, Rev. 0, “NED [Nuclear Energy Systems and Services Division Software Safety] Power Range Monitoring System Requirements Traceability Matrix,” was revised to describe how the failure of the watchdog timer is transmitted to the Average Power Range Monitoring.
Please describe how the test of the watchdog timer was performed and the configuration used.

RESPONSE:

No. 117 of the RTM in the Appendix of the FPG-DRT-C51-0027, Rev.0 describes that a watchdog timer* in the RCV module detects a failure of the FPGAs. Section 10.1.1 of the RCV Module Design Specification (5G8HC109) describes the watchdog timer of the RCV module. If the watchdog timer of the RCV module detects a failure of the FPGAs, it sets the RCV_ERR signal to ON, which is transmitted to the Average Power Range Monitoring.

As described in Section 4.4.6.1.8 of Table IV-4-2 of LTR Part IV Rev.3, each watchdog timer can be checked for correct operation by removal of a jumper on the printed circuit (PC) board. In the module validation testing of the RCV module, the tester removed the jumper and checked the RCV_ERR signal on the test computer connected to the RCV module, because the RCV_ERR signal is a signal communicated between modules via the unit middle plane. The test record of the RCV module validation testing shows that the RCV_ERR signal was set to ON when the jumper was removed.

The test steps of the watchdog timer were also documented in the test records of the Operability tests in the Pre-Qualification Test and the Post Qualification Test. Toshiba document E2-2016-000715 Rev.0, which was uploaded on the Toshiba portal on September 16, 2016 included the test steps and test records of the watchdog timer test of the RCV module. As shown in the document’s pdf Pages 81 to 84 for Pre-Qualification Tests and Pages 201 to 204 for the Post Qualification Tests, the module was uninstalled, the setting of the jumper of the watchdog timer to be tested was changed and the module was re-installed to perform the watchdog timer test. Note that the status of the LEDs of the STATUS module, which reflected the status of the RCV_ERR signal, was confirmed in the test.

* As described in Appendix II-B of LTR Part II Rev.4, the RCV module has four independent data processing trains. Each data processing train has a separate watchdog timer.