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10 CFR 52.99(c)(1)

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

Subject: Virgil C. Summer Nuclear Station (VCSNS) Unit 3
Combined License No. NPF-94
Docket Number 52-028
ITAAC Closure Notification on Completion of ITAAC 2.5.01.03c [Index No. 513]

Attachments: References

The purpose of this letter is to notify the Nuclear Regulatory Commission (NRC) in accordance with 10 CFR 52.99(c)(1) of the completion of Virgil C. Summer Nuclear Station (VCSNS) Unit 3 Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) Item 2.5.01.03c for verifying that any Diverse Actuation System (DAS) algorithms, logic, program architecture, executable operating systems, and executable software/logic are different than those used in the Protection and Safety Monitoring System (PMS). The closure process for this ITAAC is based on the guidance described in NEI 08-01 (Reference 1), which was endorsed by the NRC in Regulatory Guide 1.215. This ITAAC Closure Notification (ICN) supersedes the ICN dated May 03, 2016 (ML16124A954). This resubmittal is in response to “Notice of Insufficient Information in ITAAC Closure Notification for ITAAC 2.5.01.03c (INDEX No. 513)” dated July 25, 2016 (ML16173A320).

ITAAC Statement

Design Commitment:

3.c) Software diversity between the DAS and PMS will be achieved through the use of different algorithms, logic, program architecture, executable operating system, and executable software/logic.

Inspections, Tests, Analyses:

Inspection of the DAS and PMS design documentation will be performed.

Acceptance Criteria:

Any DAS algorithms, logic, program architecture, executable operating systems, and executable software/logic are different than those used in the PMS.

ITAAC Determination Basis

An inspection of design documentation was performed to verify the algorithms, logic, program architecture, executable operating systems, and executable software/logic used within the DAS are different than those used in the PMS.

The basis of diversity used for prevention of common mode failure is established by Sections 2.6.3 and 3.2.6 of NUREG/CR-6303, "Method for Performing Diversity and Defense-In-Depth Analyses of Reactor Protection Systems" (Reference 2). The DAS and PMS software were assessed on the elements of diversity established within the ITAAC Acceptance Criteria. The results of this inspection are documented in the AP1000 Diverse Actuation System Diversity Analysis (Reference 3). A summary of the inspection of differences between the DAS and PMS software are shown in the following table:

		PMS	
Diversity Type	**DAS (Field Programmable Gate Array (FPGA) Based)**	**Common Qualified Platform (Common Q – Processor Based)**	**Component Interface Module (CIM) Subsystem (FPGA Based)**
Algorithms	The DAS is a digital system that provides plant protective actions based on setpoint comparisons to plant parameter incoming signals. Inspection of the DAS algorithms concluded the DAS uses simple mathematical conversion calculations to convert raw signal levels to percent of scale values and comparison with setpoints. DAS also uses Cyclic Redundancy Check (CRC) for digital communications. DAS CRC polynomial implementation was inspected and concluded that DAS CRC uses different code implementation from the PMS CIM subsystem.	PMS is a digital system that provides plant protective actions based on setpoint comparisons to plant parameter incoming signals. Inspection of PMS algorithms implemented in Common Q concluded that PMS uses numerous calculations based on complex operation that are different than DAS scaling conversions.	The CIM subsystem is a component of PMS that provides priority control of the components and feedback. Inspection of CIM concluded that CIM does not use mathematical calculations (i.e., algorithms) for its operation. CIM uses simple priority logic to establish priority of commands. CIM uses CRC for digital communications. CIM CRC polynomial implementation was inspected and concluded that CIM CRC uses different code implementation from the DAS subsystem.
Logic	Inspection of DAS implementation concluded that DAS uses Field Programmable Gate Array (FPGA) technology. Inspection of the design also concluded that the CIM portion of PMS uses FPGA but DAS FPGA is different than CIM FPGA, specifically: - Different gate structure / over one million gates - Different clock cycle - Larger Random Access Memory (RAM) - Larger number of I/O channels - Six Phase-Locked Loops	Inspection of Common Q portion of PMS concluded that logic is performed within software. The Common Q portion of PMS is processor based which is different than FPGA.	Inspection of CIM design concluded that CIM uses FPGA that is different than DAS FPGA, specifically: - Different gate structure / Less than one million gates - Different clock cycle - Smaller RAM - Smaller number of I/O channels - Two Phase-Locked Loops

Diversity Type	DAS (Field Programmable Gate Array (FPGA) Based)	PMS	
		Common Qualified Platform (Common Q – Processor Based)	**Component Interface Module (CIM) Subsystem (FPGA Based)**
Program Architecture	Inspection of the design documents concluded that DAS uses FPGA that is different than PMS Common Q (processor based) and CIM FPGA (see Logic section above). In addition, DAS program architecture has the following unique features that are different than CIM: - Different clock conditioning circuits (e.g., frequency, delay, number of blocks) - Different communication bus architecture / protocol - Different size chip	Common Q portion of PMS was inspected and it was concluded that it is Central Processing Unit (CPU) based which is different than DAS FPGA. Inspection also concluded that PMS also uses different communication bus architecture / protocol than DAS.	Inspection of the design documents concluded that CIM uses FPGA that is different than DAS FPGA (see Logic section above). In addition, CIM program architecture has the following unique features that are different than DAS: - Different clock conditioning circuits (e.g., frequency, delay, number of blocks) - Different communication architecture / protocol - Different size chip
Executable Operating Systems	Inspection of DAS design concluded that executable operating systems are not used for its operation since it is FPGA based.	Inspection of PMS design concluded that PMS uses proprietary operating system. In contrast, DAS does not use executable operating system.	Inspection of CIM design concluded that executable operating system is not used for its operation since it is FPGA based. CIM uses FPGA that is different than DAS FPGA (see Logic section above).
Executable Software/Logic	Inspection of DAS design concluded that DAS does not have executable software since it is FPGA based. Inspection of DAS FPGA also concluded that there is no software based executable logic. The logic operation is performed by unique gate structure that is different than CIM (see Logic and Program Architecture sections above).	Inspection of Common Q portion of PMS executable software/logic concluded that it uses a combination of proprietary and common programming language in contrast with DAS which is FPGA based.	Inspection of CIM design concluded that CIM does not have executable software since it is FPGA based. Inspection of CIM FPGA also concluded that there is no software based executable logic. The logic operation is performed by unique gate structure that is different than DAS (see Logic and Program Architecture sections above).

Note: Specific model numbers and low level details are not included due to cyber security considerations.

Reference 3 concludes that software diversity between DAS and PMS has been achieved through the use of different algorithms, logic, program architecture, executable operating systems, and executable software/logic.

ITAAC Finding Review

In accordance with plant procedures for ITAAC completion, SCE&G performed a review of all findings pertaining to the subject ITAAC and associated corrective actions. This review found that there are no relevant ITAAC findings associated with this ITAAC. The ITAAC completion review is documented in the ITAAC Completion Package for ITAAC 2.5.01.03c (Reference 4) and available for NRC inspection.

ITAAC Completion Statement

Based on the above information, SCE&G hereby notifies the NRC that ITAAC 2.5.01.03c was performed for VCSNS Unit 3 and that the prescribed acceptance criteria are met.

Systems, structures, and components verified as part of this ITAAC are being maintained in their as-designed, ITAAC compliant condition in accordance with approved plant programs and procedures.

We request NRC staff confirmation of this determination and publication of the required notice in the Federal Register per 10 CFR 52.99(e)(1).

If there are any questions, please contact Ryder Thompson at (803) 941-9812.

Sincerely,

FOR April R. Rice
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RT/AR/hz

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References (available for NRC inspection):

1. NEI 08-01, Industry Guideline for the ITAAC Closure Process Under 10 CFR Part 52.

2. NUREG/CR-6303, Method for Performing Diversity and Defense-in-Depth Analyses of Reactor Protection Systems

3. APP-DAS-J0R-002, AP1000 Diverse Actuation System Diversity Analysis

4. ITAAC 2.5.01.03c Completion Package