

**Staff Position on
AP1000 Digital Instrumentation & Control
Inspections, Tests, Analyses, and Acceptance Criteria Completion**

Background

The Vogtle Electric Generating Plant Units 3 and 4 and Virgil C. Summer Nuclear Station Units 2 and 3 Combined Operating Licenses (COLs) include four Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) that require development, using rigorous design processes, of the following:

- AP1000 Protection and Safety Monitoring System (PMS), designated as ITAACs 550 and 551
- PMS Component Interface Module (CIM), designated as ITAAC 553
- Diverse Actuation System (DAS), designated as ITAAC 519

Each of these process-based ITAAC specifies an Inspection, Tests, Analyses (ITA) component that requires “Inspection (and/or audit for ITAAC 553) will be performed of the process(es) used....” in design and development of the digital instrumentation and control (DI&C) systems, and an Acceptance Criteria (AC) component that specifies a report be developed (“A report exists....”) that concludes that the specific requirements of that ITAAC have been met.

For closure of these ITAAC, the AP1000 licensees had planned to address only the DI&C development process. The staff does not agree with this interpretation of the ITAAC language because the ITAAC require inspection of the process as actually used. The AP1000 Staff Evaluation Report confirms that the ITAAC encompass implementation, consistent with the ITAAC’s purpose to verify the as-built system. The language in the ITAAC support an additional implementation component, and that implementation results (i.e., design outputs) must also be addressed in the ITAAC closure documentation.

The NRC and its stakeholders have discussed the interpretation of this issue in various public meetings.

Discussion

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 52.99(c)(1), a licensee must notify the U.S. Nuclear Regulatory Commission (NRC) that the prescribed ITA for each ITAAC have been performed and that the prescribed AC are met. The ITAAC closure notification (ICN) must contain sufficient information to demonstrate that the prescribed ITA was performed and that the prescribed AC is met. Understanding the scope of an ITAAC design commitment, the ITA requirements and the AC is fundamental to compliance with ICN requirements.

Expectation for DI&C ITA

Licensees are required to perform these ITA and must provide documented evidence of performance. For example, licensees should address the following list of questions, which is not all inclusive:

- What methodologies were employed?
- What activities were performed?
- What assumptions were made?
- What conclusions were drawn?

“Inspection” implies not just a review of the process (i.e., methodology and procedures), but must also include an assessment of the implementation of the process, including process results, identification of issues and resolution, overall effectiveness, etc. For these DI&C ITAAC, inspection must validate that the process has the necessary rigor and robustness to yield appropriate design outputs, address the complexities of DI&C design and development, and will ultimately fulfill the intent of the ITAAC.

ITAAC 519, 550 and 553 are specific to the DI&C hardware and software for the DAS, PMS and PMS-CIM, respectively, and generally mirror a typical DI&C design/development life cycle from establishment of requirements through installation. The staff expects that licensees will perform ITA activities for these systems through installation and compile the associated principal closure document (PCD) and ICN with the necessary detail to demonstrate: 1) How the ITA was performed, and 2) How performance of the ITA validates that the acceptance criteria have been met.

Once an ICN is submitted, licensees begin ITAAC maintenance. DI&C implementation activities would continue as needed. Any issues would be governed by ITAAC maintenance procedures and the thresholds for post-closure notification outlined in NEI 08-01 and Regulatory Guide 1.215.

Additional Considerations

ITAAC 551 is specific to PMS software and includes a software maintenance element. For the PMS, the general protocol for transition from software installation to the software maintenance environment is as follows:

- PMS hardware installation is completed and hardware is turned over to the Initial Test Program (ITP).
- PMS software is installed (i.e., loaded) and checked out on the hardware (i.e., software engineering).
- Complete PMS turned over to ITP.
- ITP begins PMS component and pre-operational testing; any changes to the PMS software (i.e., software maintenance) are administered through ITP procedures.

The time from the start of ITP until the 10 CFR 52.103(g) finding may afford opportunities for implementation of the software maintenance processes for the PMS. The staff may inspect this

implementation, as appropriate. If the licensee performs PMS software maintenance activities, ITAAC 551 should be the last of these four DI&C ITAAC to be completed and ICN submitted.

The licensees may determine that no PMS software maintenance activities are anticipated to occur during ITP. In this instance, in lieu of providing software maintenance implementation details in the PCD and ICN, licensees should provide details of the software maintenance processes and explain the basis for the determination that no PMS software maintenance activities are expected. The staff may inspect this implementation, as appropriate. Following submittal of the ICN, any subsequent activities, including emergent software maintenance, will be subject to the ITAAC maintenance process.

AP1000 Revision 19, Section 2.5.1 and Section 2.5.2

ITAAC #553

14. The Component Interface Module (CIM) is developed using a planned design process which provides for specific design documentation and reviews. {Design Acceptance Criteria}	An inspection and or an audit will be performed of the processes used to design the hardware, development software, qualification and testing	A report exists and concludes that CIM meets the below listed life cycle stages. Life cycle stages: a) Design requirements phase, may be referred to as conceptual or project definition phase b) System definition phase c) Hardware and software development phase, consisting of hardware and software design and implementation d) System integration and test phase e) Installation
---	---	--

ITAAC #519

4. The DAS hardware and any software are developed using a planned design process which provides for specific design documentation and reviews during the following life cycle stages: a) Development phase for hardware and any software b) System test phase c) Installation phase d) The planned design process also provides for the use of commercial off-the-shelf hardware and software.	Inspection will be performed of the process used to design the hardware and any software.	A report exists and concludes that the process defines the organizational responsibilities, activities, and configuration management controls for the following: a) Documentation and review of hardware and any software. b) Performance of tests and the documentation of test results during the system test phase. c) Performance of tests and inspections during the installation phase. d) The process also defines requirements for the use of commercial off-the-shelf hardware and software.
---	---	---

ITAAC #550

<p>11. The PMS hardware and software is developed using a planned design process which provides for specific design documentation and reviews during the following life cycle stages:</p> <ul style="list-style-type: none"> a) Not used b) System definition phase c) Hardware and software development phase, consisting of hardware and software design and implementation d) System integration and test phase e) Installation phase 	<p>Inspection will be performed of the process used to design the hardware and software.</p>	<p>A report exists and concludes that the process defines the organizational responsibilities, activities, and configuration management controls for the following:</p> <ul style="list-style-type: none"> a) Not used. b) Specification of functional requirements. c) Documentation and review of hardware and software. d) Performance of system tests and the documentation of system test results, including a response time test performed under maximum CPU loading to demonstrate that the PMS can fulfill its response time criteria. e) Performance of installation tests and inspections.
---	--	---

ITAAC #551

<p>12. The PMS software is designed, tested, installed, and maintained using a process which incorporates a graded approach according to the relative importance of the software to safety and specifies requirements for:</p> <ul style="list-style-type: none"> a) Software management including documentation requirements, standards, review requirements, and procedures for problem reporting and corrective action. b) Software configuration management including historical records of software and control of software changes. c) Verification and validation including requirements for reviewer independence. 	<p>Inspection will be performed of the process used to design, test, install, and maintain the PMS software.</p>	<p>A report exists and concludes that the process establishes a method for classifying the PMS software elements according to their relative importance to safety and specifies requirements for software assigned to each safety classification. The report also concludes that requirements are provided for the following software development functions:</p> <ul style="list-style-type: none"> a) Software management including documentation requirements, standards, review requirements, and procedures for problem reporting and corrective action. Software management requirements may be documented in the software quality assurance plan, software management plan, software development plan, software safety plan, and software operation and maintenance plan; or these requirements may be combined into a single software management plan. b) Software configuration management including historical records of software and control of software changes. Software configuration management requirements are provided in the software configuration management plan.
---	--	---

		c) Verification and validation including requirements for reviewer independence. Verification and validation requirements are provided in the verification and validation plan.
--	--	---