

Simulated ITAAC Closure and Verification Demonstration Final Report



July 15, 2011

Calvin Cheung

Construction ITAAC Team

Office of New Reactors, Division of Construction Inspection and Operational Programs

Executive Summary

U.S. Nuclear Regulatory Commission (NRC) staff and industry stakeholders, including the U.S. Department of Energy (DOE) [as project sponsor], the Nuclear Energy Institute (NEI), Westinghouse Electric Company (WEC), and Southern Nuclear Company (SNC), recently completed a demonstration project that simulated the closure and verification of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). The Demonstration, which formally began in July 2010 and concluded in April 2011, was performed to verify that both the industry's and NRC's ITAAC closure and verification processes reliably and efficiently support ITAAC closure. Several lessons learned and next steps were identified during the Demonstration and interactions among participants. Some of the key lessons learned are highlighted below.

One initial significant lesson learned is that the technical assistance request (TAR) process, used for two-way communication between NRC Headquarters and Region II staff, requires refinement, to improve efficiency and the coordination of inspection support activities.

The NRC staff recognized that the Construction Inspection Program Information Management System (CIPIMS), used during this Demonstration, did not meet all users' requirements. The staff intended to use CIPIMS as a tool to plan, manage, record, and report inspection results related to reactor and vendor construction activities. The Demonstration confirmed that several CIPIMS features need further changes or enhancements. These changes and enhancements were previously identified and are included in CIPIMS 2.0, which is currently under development and scheduled to be completed in early calendar year 2012. Another information technology (IT) system identified during the Demonstration as a key component of the ITAAC closure verification process is the Verification of ITAAC Closure, Evaluation, and Status (VOICES) system. VOICES is intended to track the status of the staff's closure verification and will interact with CIPIMS and other existing IT infrastructure. However, VOICES is not yet developed and, therefore, was not exercised as part of the Demonstration. Plans call for its development in the near future with completion scheduled for the middle of calendar year 2012.

Simulating the performance, inspection, and closure of ITAAC selected for this Demonstration, identified the intent of some ITAAC requires clarification. Specifically, the stakeholders identified different interpretations exists for the functional arrangement ITAAC, report ITAAC, and the Design Reliability Assurance Program ITAAC. These ITAAC were the subject of topics at public workshops with stakeholders throughout the Demonstration and continued work is planned to resolve the differing interpretations of their intent.

The participants also recognized that ITAAC closure notifications (ICNs) need to be written in a clear, succinct, and fully developed manner. During the Demonstration, the staff required several rounds of reviews to fully verify all ICNs. Some issues were the result of a misinterpretation of ITAAC intent and differing expectations for supporting reference material. Initial steps to enhance the industry guidance document, NEI 08-01, "Industry Guidance for the ITAAC Closure Process Under 10 CFR Part 52," which is endorsed by NRC Regulatory Guide 1.215, "Guidance for ITAAC Closure Under 10 CFR Part 52," are under way as a result of

the lessons learned from this Demonstration. Some of these enhancements include preparing additional ICN examples, clarifying details on how to use the ICN examples, and developing expectations for ICN content.

A separate objective of this Demonstration was to evaluate the expected surge in ICNs during the last year of construction and to identify recommendations to manage the increase. For example, industry participants have suggested that the NRC staff review of the 10 CFR 52.99(c)(2) uncompleted ITAAC notifications (225-day letters) could potentially mitigate the effects of the surge. The NRC staff is already categorizing ITAAC by type and is working with stakeholders to prepare additional ICN examples for NEI 08-01 and RG 1.215.

The Demonstration has been valuable in exercising many aspects of the ITAAC closure and verification process, and resulted in many changes and refinements, including development of office instructions for the ITAAC Closure Verification Process and the 10 CFR 52.103(g) Commission Finding.

Simulated ITAAC Closure and Verification Demonstration Final Report

Contents

EXECUTIVE SUMMARY	2
1.0 INTRODUCTION.....	5
2.0 SCOPE OF PROJECT.....	7
2.1 OBJECTIVE AND APPROACH.....	7
2.2 FOUR STAGES OF THE DEMONSTRATION	7
2.3 MILESTONES.....	9
3.0 LESSONS LEARNED.....	10
3.1 COMMUNICATION	10
3.2 INFORMATION TECHNOLOGY INFRASTRUCTURE	12
3.3 INSPECTIONS	13
3.4 ITAAC CLOSURE VERIFICATION	14
3.5 ITAAC COMPLETION PACKAGES.....	17
3.6 SURGE IN ITAAC SUBMITTALS.....	17
4.0 PROPOSED NEXT STEPS	18
4.1 KEY NEXT STEPS.....	18
4.2 OFFICE INSTRUCTION DEVELOPMENT.....	19
4.3 ITAAC INTENT RESOLUTION.....	20
5.0 CONCLUSION	22
6.0 DEMONSTRATION ITAAC	23
7.0 ACRONYMS AND ABBREVIATIONS	26

1.0 Introduction

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” requires combined license (COL) holders to submit and perform inspections, tests, analyses, and acceptance criteria (ITAAC) to provide reasonable assurance that, if the ITAAC are successfully completed, the facility has been constructed and will be operated in conformity with the COL, the Atomic Energy Act, and the Commission’s rules and regulations. The licensee notifies the U.S. Nuclear Regulatory Commission (NRC) that it has completed each ITAAC by submitting an ITAAC closure notification (ICN)¹ stating that the inspections, tests, and analyses (ITA) have been performed and that the acceptance criteria (AC) have been met. In turn, the NRC staff will review all ICNs to verify that the ITAAC have been successfully completed, verify that a majority of the ITAAC inspections in the corresponding family have been completed, and will then issue a *Federal Register* notice (FRN) of its determination of the successful completion of the ITAAC.² When the staff has verified that all ITAAC have been closed, the staff will notify the Commission. If the Commission finds under 10 CFR 52.103(g) that all the AC are met, then the licensee may operate the facility.

Currently, the NRC staff is gaining experience by inspecting the ITAAC contained in the Vogtle Units 3 and 4 limited work authorization. Additionally, the NRC staff has several initiatives in progress to ensure that the ITAAC closure and verification processes are effective and efficient. These initiatives include the following:

- (1) holding NRC internal workshops to develop the inspection strategy and exercise the ITAAC closure verification process (ICVP)
- (2) working with the industry on the development and refinement of the ITAAC schedules
- (3) preparing proposed rule language for ITAAC maintenance
- (4) holding bimonthly Category 3 public workshops with stakeholders to evaluate and resolve issues associated with ITAAC closure
- (5) issuing Regulatory Issue Summary (RIS) 2008-05, Revision 1, “Lessons Learned To Improve Inspections, Tests, Analyses, and Acceptance Criteria Submittal,” dated September 23, 2010, on ITAAC quality and inspectability and conducting related internal training based on this document
- (6) conducting licensing reviews of ITAAC for quality, clarity and inspectability under NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” Section 14.3

¹ This was formerly referred to as an ITAAC Closure Letter.

² According to 10 CFR 52.99(e), FRNs of successful ITAAC completion are to be issued at appropriate intervals until the last date for the submission of hearing requests on ITAAC completion.

In addition to these ongoing activities, the U.S. Department of Energy (DOE) proposed and sponsored this exercise with the NRC and the industry to demonstrate the performance, inspection, review, and closure of ITAAC. The staff and DOE agreed to cooperatively pursue this Demonstration project. This exercise, the Simulated ITAAC Closure and Verification Demonstration (Demonstration), was valuable because previous commercial reactors that were constructed and licensed under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," did not use ITAAC. Exercising the industry ITAAC closure process and the NRC ITAAC closure verification process proved to be insightful and identified many areas for refinement. Furthermore, the industry and the NRC staff have long known that a substantial percentage of ITAAC will be completed in the final year leading to the scheduled date for fuel load. Accordingly, through discussions with DOE on its proposal, the NRC staff suggested a study on the expected surge in ITAAC submittals during the last stages of construction, to evaluate possible strategies to effectively and efficiently complete the reviews at the end of the construction process. The NRC staff facilitated the ITAAC closure process, including the coordination of efforts with the Demonstration licensee and reactor vendor. All parties performed their respective activities as defined in 10 CFR Part 52. Additionally, the Demonstration reactor vendor analyzed the expected ITAAC surge.

2.0 Scope of Project

2.1 Objective and Approach

The objective of the Demonstration was to verify that both the industry ITAAC closure process and the NRC ITAAC verification process can reliably and efficiently support ITAAC closure. Specifically, the industry simulated the development of several ITAAC closure documents and the submission of the associated ICNs under 10 CFR 52.99(c)(1). During this process, the staff of the NRC Region II Center for Construction Inspection (RII/CCI) simulated inspection planning, inspection, and documentation of inspection results in the Construction Inspection Program Information Management System (CIPIMS). The NRC Office of New Reactors (NRO) reviewed the simulated ICNs submitted by the licensee and the inspection results documented in CIPIMS.

For purposes of this Demonstration, ITAAC are assumed to exist, the COL has been granted, and the plant is under construction. Actual RII/CCI inspections did not take place; rather, inspection data was simulated to test the processes. Participants in this exercise included the NRC, DOE as a project sponsor, Westinghouse Electric Company (WEC) as the participating Demonstration reactor vendor and Southern Nuclear Company (SNC) as the participating Demonstration licensee. Section 6.0 of this report describes the six ITAAC chosen to be exercised as part of the Demonstration. The ITAAC were selected to represent a range of technical disciplines and complexity.

Lastly, the exercise involved an evaluation by WEC on the surge in ICN submittals expected during the last year of construction of a new nuclear power plant.

2.2 Four Stages of the Demonstration

The Demonstration included four stages: ITAAC Performance and NRC Inspection, ITAAC Closure, Exercise Workshop, and Lessons Learned.

2.2.1 Stage 1—ITAAC Performance and NRC Inspection

The licensee simulated the performance of the selected ITAAC and developed the documentation required to support ITAAC closure. As part of the ITAAC completion package, the licensee prepared ICN's to provide information sufficient to demonstrate that the ITA had been performed and that the AC had been met, based on the examples provided in Nuclear Energy Institute (NEI) 08-01, "Industry Guideline for the ITAAC Closure under 10 CFR Part 52," which is endorsed by NRC Regulatory Guide (RG) 1.215, "Guidance for ITAAC Closure under 10 CFR Part 52." Concurrently, RII/CCI staff prepared an inspection plan for the selected ITAAC, simulated inspections, documented the simulated inspection results in CIPIMS, and generated two inspection reports with three simulated notices of violation (NOVs).

Stage 1 of the exercise concluded when the ITAAC performance demonstration was completed and when the ITAAC completion packages were prepared and submitted to the NRC.

2.2.2 Stage 2—ITAAC Closure Verification

Once the ICNs were submitted to and received by the NRC, the staff exercised the NRC's ICVP. The NRO staff processed and reviewed the ICNs as outlined in the draft ICVP office instruction and its appendices. This review included the use of NRO technical staff, as needed.

The NRC initially used a two-phase process (acceptance and technical) to review the ICNs. The NRC did not initially accept some ICN's because of formatting or other administrative reasons, not material to the closure and verification of the ITAAC. It did not accept other letters because of errors material to the closure and verification of the ITAAC that required correction by the licensee. The NRC provided feedback to the licensee and judged the final ICNs to be sufficient to adequately verify closure of each ITAAC. As a result of this review and the evolution of the review process, the staff recognized that an acceptance review phase is not necessary, and it will revise the draft ICVP office instruction to reflect this.

Certain ICNs required onsite inspections at Vogtle Units 3 and 4 in Waynesboro, GA, and at the WEC facility in Cranberry, PA, to review and inspect the contents of the ITAAC Completion packages. With the support of RII/CCI, the NRO staff performed the necessary onsite inspections.

Stage 2 of the exercise concluded when the staff verified proper ITAAC closure and simulated the publishing of the associated FRN.

2.2.3 Stage 3—Exercise Workshops

The NRC held multiple public workshops to summarize and discuss the exercise and to present comments on the ICNs. Participants discussed their observations of the exercise, identified issues with the process, and proposed solutions. WEC also presented the analysis results of the makeup and volumes of the system-specific ITAAC in the expected surge of ICN submittals during the last year of construction. The participants discussed in detail the issues associated with the expected surge in ITAAC to identify strategies to minimize any schedule impact.

Stage 3 of the exercise concluded when the participants completed the workshops and achieved the goals of the Demonstration.

2.2.4 Stage 4—Lessons Learned and Next Steps

The NRC documented lessons learned as part of this Demonstration final report to highlight successes in the ICVP and to provide detailed areas that could be further refined. Sections 3.0 and 4.0 discuss in detail the specific lessons learned and next steps, respectively. The report includes input gathered from participants and the public throughout the exercise and during the public workshops.

2.3 Milestones

Throughout the Demonstration, the following defined milestones were developed to track progress:

Date	Milestone Task
7/29/10	Public Meeting—Kickoff
8/19/10	Public Meeting—Progress Update
9/14/10	Simulated Inspection at Vogtle 3 and 4
9/22/10	Simulated Inspection at WEC Headquarters
10/07/10	Public Meeting—Progress Update
10/27/10	Region II/CCI Issues Integrated Inspection Report
11/03/10	Public Call—D-RAP ITAAC
11/10/10	Closed Meeting—Surge in ITAAC Evaluation (Proprietary)
11/11/10	Westinghouse/Southern Submit ICN to NRC
12/09/10	Public Meeting—Progress Update
1/26/11	NRC Completes ITAAC Closure Verification
1/27/11	Public Meeting—Demonstration Workshop
3/31/11	Public Meeting—Lessons Learned
4/20/11	Public Call—Next Steps

3.0 Lessons Learned

Based on the results of the Demonstration and interactions with the industry and the public, participants identified several lessons learned. The staff grouped the lessons learned from the Demonstration into six general categories: Communication, Information Technology (IT) Infrastructure, Inspections, ITAAC Closure Verification, ITAAC Completion Packages, and ITAAC Surge.

3.1 Communication

Effective communication among the NRC (Offices within Headquarters and Regions), the industry, and the public is required. The Demonstration exercised and developed many communication channels and substantiated the importance of effective communications. Under the area of Communication, the Demonstration identified the lessons learned described below.

3.1.1 Refinement of the Technical Assistance Request Process

The NRC used the existing technical assistance request (TAR) process to request technical support between a Regional Office and NRC Headquarters. The NRC staff exercised the TAR process during the Demonstration in two instances. The first instance occurred when RII/CCI inspectors requested assistance from the NRO technical staff to support the simulated ITAAC inspections for those ITAAC that required specialized technical expertise. The second instance occurred when NRO operations engineers requested an emergent inspection on a non-targeted ITAAC because of an issue with ITAAC closure identified during the NRC verification process. Based on these experiences, the staff recognized the need to further refine the TAR process to facilitate clearer and more effective communications between RII/CCI inspectors and the NRO staff, particularly in communicating NRO requests for emergent inspections. Before the Demonstration, the TAR process had been developed as a preliminary draft procedure that only accommodated one-way communication from RII/CCI to NRO. During the Demonstration, the staff developed a form to be attached to the draft procedure to facilitate two-way communication. The experiences gained during the Demonstration were used to refine the procedure to allow effective two-way communication.

3.1.2 Communication of Nonverification of an ITAAC Closure Notification

The licensee initially submitted nine ICNs for NRC review. Nine ICNs were submitted instead of six, because the licensee divided one ITAAC into four discrete subsections. For each subsection, the licensee submitted partial ICNs, increasing the total ICNs submitted from six to nine (Section 3.4.1 discusses in detail the lessons learned related to partial ICNs). The staff reviewed the submitted letters in accordance with the draft ICVP office instruction. During the Demonstration, some of the submitted ICNs lacked sufficient information and could not be verified. The NRC provided feedback to the licensee by e-mail and verbally at the public workshops. This process was acceptable for the Demonstration, since it exercised only a limited number of ITAAC. The staff found it would need a more efficient and formalized method

to communicate questions and nonverification of ICNs to licensees, as the number of ICNs submitted during construction will be significantly higher and time sensitive. Therefore, a more formal process will be defined and added to the ICVP office instruction.

3.1.3 Facilitate the Process Leading to 10 CFR 52.103(g)

Section 10 CFR 52.103(g) states, in part, that the licensee shall not operate the facility until the Commission makes a finding that the AC in the COL are met. Once the NRC staff has reviewed all ICNs and verified the closure of all ITAAC, it will recommend to the Commission to find that the AC are met. This communication from the staff to the Commission was not exercised in the Demonstration but was identified as a process that requires development.

As a result, guidance for this process is under development. The staff has prepared a draft office instruction and the associated SECY paper template for notifying the Commission. These documents are currently under internal NRC review.

3.1.4 Develop Federal Register Notice Template Documenting Staff Determination

Section 10 CFR 52.99(e) states, in part, that the NRC shall publish an FRN of the staff's determination of the successful completion of ITA. During the Demonstration, the submitted ICNs were reviewed under the draft office instruction for the ICVP and verified as closed. To simulate the publishing of an FRN for the verified ITAAC, the NRO staff developed an FRN template, in coordination with the Office of Administration and the Office of the General Counsel (OGC), and used it to draft the simulated notices to document the staff's determination. This template will be added to the office instruction for the ICVP.

3.1.5 ICNs Sent Directly to Reviewers

The NRC staff established an independent NRC project number for the Demonstration to avoid any confusion between the actual Vogtle Units 3 and 4 COL applications and the simulated work at Vogtle Units 3 and 4 performed as part of the Demonstration. This also allowed the staff to apply the established process to submit and retrieve documents submitted to the NRC under 10 CFR Part 52 for ITAAC closure verification. In addition to the independent project number, the staff requested a distribution list that is in accordance with the draft ICVP office instruction. The distribution list included, in addition to the standard distribution list, the Branch Chief of the NRO ITAAC team and the NRO Demonstration project engineer coordinating the review. The direct distribution, after receipt by the Document Control Room, to the NRO reactor operations engineers proved crucial in processing the submitted ICNs efficiently. Such an approach is especially important during the surge in ICN submittals expected during the last stages of construction. The NRO reactor operations engineers were able to process the ICNs in an efficient and effective manner. However, the Demonstration included only six ICNs, whereas the number of ICNs to be received and reviewed during actual construction may exceed 1,000 per single unit. Considering the potential for subjectivity associated with interpreting existing ITAAC wording and performing ICN reviews, the Demonstration clearly showed that ICNs should be reviewed by NRO reactor operations engineering who are very familiar with the

ITAAC closure process and ICN content, as described in NEI 08-01 and RG 1.215. This recommendation has already been incorporated into the draft ICVP office instruction.

3.2 Information Technology Infrastructure

The staff exercised several of the existing NRC IT systems during the Demonstration. In this report, lessons learned are limited to the NRC systems unique to ITAAC closure, which are discussed in the subsections below.

3.2.1 Construction Inspection Program Information Management System Requires Further Refinement

CIPIMS is a database intended to be used by the staff to plan, manage, and record inspections related to new reactor and vendor construction activities. The database is also intended to generate inspection reports and cover letters. The existing version of CIPIMS has known issues with features and modules that were not fully developed. Various staff members used CIPIMS during the simulated inspections and ITAAC closure verification. NRO vendor inspectors documented a simulated inspection. Such vendor inspections occur before the issuance of the license and are therefore linked to vendors and systems rather than a specific ITAAC. RII/CCI documented a simulated ITAAC inspection that occurs after the license is issued. NRO reactor operations engineers retrieved the documented information in CIPIMS as part of ITAAC closure verification to ensure that all associated findings were closed before verifying that the ITAAC were closed.

As the NRC staff used CIPIMS to document and retrieve information relating to ITAAC, they verified that the current version of the system does not yet include all the features and modules that are needed to efficiently verify closure of ITAAC. Exercising CIPIMS proved to be valuable in verifying known issues and identifying new ones. Currently, CIPIMS does not contain ITAAC lists, which resulted in a delay in documenting the inspections results. Manually adding the six Demonstration ITAAC to the system was difficult. CIPIMS was unable to create inspection reports, document NOVs, and generate inspection report cover letters. In addition, the NRO vendor inspectors did not find the system user friendly, as it had not sufficiently developed the specific modules to document vendor inspections and generate inspection reports. The vendor inspectors had to manually copy and paste the results of inspections into CIPIMS and were not able to generate a report. NRO reactors operations engineers also faced several challenges when using CIPIMS. The staff indicated they had difficulty obtaining relevant ITAAC information when using the system, since a search by ITAAC feature does not yet exist. This is considered a primary function to aid the staff in verifying ITAAC closure.

These features and modules are critically important, as CIPIMS is a tool that facilitates inspection results and ITAAC closure. Work is continuing to revise and develop a new version of CIPIMS that will take into consideration many of these lessons learned and include the features verified as necessary for efficient ITAAC closure. The new version, CIPIMS 2.0, is scheduled to be completed in early calendar year 2012.

3.2.2 Verification of ITAAC Closure, Evaluation, and Status System

The Verification of ITAAC Closure, Evaluation, and Status (VOICES) system is a workflow tracking system intended as a tool to facilitate the verification of ITAAC closure. VOICES was conceptualized but not developed before the Demonstration and therefore not exercised. The need for a workflow tracking tool proved necessary during the Demonstration to monitor progress and ensure that the ICN reviews were on schedule. VOICES will reside within the existing NRC internal IT work environment and will interface with other systems, such as the Agencywide Document Access and Management System and CIPIMS. The development of VOICES is tentatively scheduled to be finished by the middle of calendar year 2012.

3.3 Inspections

During Stage 1 of the Demonstration, the NRC focused on simulating planned inspections of ITAAC. During Stage 2, the NRC conducted an unplanned inspection at the request of the NRO Reactor Operations Engineer who was verifying ITAAC closure. Overall, the inspections went smoothly, with a positive interface among all stakeholders. In the area of inspections, the NRC staff identified the lessons learned described below.

3.3.1 Region II Inspection Planning and Scheduling

RII/CCI inspected the six ITAAC selected to simulate ITAAC closure and verification. Participants in the Demonstration proposed that, during the inspections, the staff identify planned simulated findings to exercise the processes for issuing NOVs, documenting them in CIPIMS, and reviewing licensee resolution of issues associated with them. After issuing the simulated NOVs, RII/CCI inspectors realized that the inspection of the licensee's corrective actions for each ITAAC-related finding had not been fully factored into work planning and scheduling. Inspection of these corrective actions is necessary for the NRC to ensure that an ITAAC has been properly closed.

RII/CCI also recognized the need to further develop a process to assign, plan, complete, and document unplanned inspections. This was identified when an NRO reactor operations engineer reviewing an ICN for a nontargeted ITAAC asked RII/CCI to inspect the ITAAC. These emergent inspections are not limited to the exercised scenario during the Demonstration and could also apply to an increase in inspection scopes resulting from other issues.

3.3.2 ITAAC intent

In a few instances, the various stakeholders questioned the intent of some ITAAC. This issue became apparent when NRO technical staff travelled to the WEC facility to support simulated inspections. The technical staff, the reactor vendor, and the licensee did not agree on what should be included in the ITAAC completion packages or on the level of detail to be contained in the technical reports. Specifically, Report and D-RAP were types of ITAAC with differing interpretations. Additionally, the participants did not agree on the definition of functional arrangement. When the licensee submitted an ICN for a functional arrangement ITAAC, the NRC staff was not able to verify ITAAC closure because of insufficient information in the ITAAC

determination basis. This required the licensee to resubmit the ICN to include a sufficient level of detail and references to the system's components, as indicated in the system description, to ensure that the ITAAC had been successfully closed.

These ITAAC intent issues were discussed as separate agenda topics at the public workshops with stakeholders throughout the Demonstration. The NRC staff is working internally on the proper interpretation of functional arrangement ITAAC. Report ITAAC, often referred to as, "a report exists" ITAAC, when discussing the AP1000 design, will continue to be a discussion topic at upcoming public meetings. Finally, additional guidance for the D-RAP ITAAC has been proposed to clarify any related issues. Section 4.3 of this report discusses in detail the next steps related to ITAAC intent.

3.4 ITAAC Closure Verification

Stage 3 of the Demonstration focused on the verification of ITAAC closure by reviewing the ICNs submitted by the licensee. Within the area of ITAAC Closure Verification, the staff identified the lessons learned described below.

3.4.1 Ensure that ICNs Are Succinct and Well Written

The review of an ICN is expected to require a minimal level of staff effort. To meet this goal, ICNs need to be written in a clear, succinct manner and should contain sufficient information. During the Demonstration, three rounds of reviews were required for the staff to fully verify that the ITAAC were closed. After each round of submittal, the staff performed its review and provided feedback to the licensee. Some of the key issues identified during this process and the staff's recommended actions are listed below.

- Restate the ITAAC in the ICN. This will ensure that the correct ITAAC addressed by the letter is being closed and that all portions of the ITA and AC are being addressed.
- List all documents material to ITAAC closure in the ICN, rather than just stating "ITAAC Completion Package." This will allow the reviewers to determine, with adequate assurance, that the licensee has taken the appropriate actions to close the ITAAC (e.g., that they comply with required industry codes, procedures, programs). In addition, this will allow the staff to identify efficiently any reference documents it may need to review.
- The licensee should clearly identify partial ICNs, if used. During the Demonstration, the licensee divided one ITAAC into four subparts and renumbered them. The licensee submitted four partial ICNs with the new ITAAC numbering but did not identify each notification as a partial submittal. Clearly labeling a partial ICN will ensure that the reviewers can easily identify it as such and allow for cross referencing and proper tracking of closure for the complete ITAAC.
- Provide a narrative description, using plain language, of the procedure followed to close the ITAAC. Including adequate information and details in the ICN will ensure that a

reasonable person can understand the basis for closure of the ITAAC. The ICN should explain how each element of the ITA was performed and how each element of the AC was met.

Applying the lessons learned from the review of these ICNs will help ensure that future submittals are succinct, well written, and ready for staff review.

3.4.2 Develop Additional ICN Examples for NEI 08-01 and RG 1.215

NEI 08-01, Revision 4, which is in the process of being endorsed through the issuance of Revision 1 to RG 1.215, contains one generic ICN template and 22 specific ICN examples as references. These examples were developed for sample ITAAC of varying complexity from various design centers. As part of the Demonstration, the licensee used the template and examples as reference tools. Since the existing examples were not identical to the ITAAC selected for the Demonstration, the licensee used the template as guidance for developing the majority of the Demonstration ICNs.

The staff required three rounds of review before it could verify all of the Demonstration ITAAC. Development of additional guidance for NEI 08-01 would allow a more efficient review, reduce uncertainty, and assist in meeting the review schedule. Such enhancements would include (1) development of additional ICN examples and (2) instructions on how to prepare ICNs using the template and examples. Section 4.1.1 of this report discusses the next steps related to the expanded ICNs examples effort and industry's enhancements to NEI 08-01 guidance to support ICNs development.

3.4.3 Develop a Verification Evaluation Form

The NRC staff reviewed the initial ICNs submitted in the Demonstration by following guidance in the draft ICVP office instruction. During the review, the staff recognized that repeated referencing to the lengthy office instruction was not the most efficient way to ensure that all elements important to ITAAC closure verification were captured. To streamline the review process, the staff, with input from Demonstration participants, developed a verification evaluation form as a tool for reviewers. This evaluation form documents the basis for verifying ITAAC closure, as described in detail in the office instruction, and will aid in standardizing the approach to reviewing ICNs. This evaluation form will be incorporated in the office instruction for the ICVP.

3.4.4 Acceptance Review

Initial reviews of ICNs submitted during the Demonstration went through a two-part review, an acceptance, followed by the closure verification review, as outlined in the draft office instruction for ICVP. During the acceptance phase, the staff identified several of the ICNs that had improper documentation or format, were mismatched to the identified NEI 08-01 examples, or had other errors not material to closure verification. As this seemed inefficient and trivial, future nonverification decisions must be based on deficiencies directly material to closure verification.

As a result, the staff has revised the draft ICVP office instruction to eliminate the acceptance review process.

3.5 ITAAC Completion Packages

The NRC staff inspected the content of the ITAAC completion packages during the two simulated inspections at the Vogtle site and at the WEC facility. RII/CCI inspectors, aided by the NRO technical staff, performed the inspections and provided feedback to the licensee on the contents and level of detail included in the closure packages. Within the area of ITAAC completion packages, the Demonstration identified the lessons learned described below.

3.5.1 Availability of Technical Reports for NRO Technical Staff

RII/CCI conducted inspections of documents contained in the ITAAC completion packages. For the more complex ITAAC, RII/CCI inspectors requested technical assistance from NRO, asking for a review of documents at the WEC facility in Cranberry, PA, to support the inspections. As part of the Demonstration, the experience gained reviewing ITAAC completion packages was valuable for both the staff and industry. The Demonstration showed that having numerous technical staff members inspect documents onsite would not always be efficient. However, the NRO technical staff can assist RII/CCI inspections by reviewing documents included in ITAAC completion packages in a virtual Web-based reading room or at a local licensee or vendor facility. Due to the proprietary natures of this information, WEC is working with the staff to find an acceptable method for providing these documents for future inspections.

3.5.2 Sufficient Information in Completion Packages

In general, the NRC staff found that the ITAAC completion packages, as presented during the Demonstration, were lacking in the expected level of detail. It is expected that the licensees will maintain the ITAAC completion packages to include the documents forming the basis for ITAAC closure and accordingly referenced in the ICNs. Therefore, sufficient detail (e.g., electrical and installation diagrams, technical reports with calculations) should be included in the completion packages to ensure that they contain all documents material to ITAAC closure and verification. It should be recognized that some of the detailed calculations or diagrams that would typically be included in the completion packages did not exist, because this was a Demonstration that only simulated the performance of the ITAAC by the licensee. The staff and industry have discussed the importance of including documents material to ITAAC closure in the closure packages as well as meeting the expected level of details in each of these documents.

3.6 Surge in ITAAC Submittals

During the actual construction of a new nuclear power plant, a surge in the submittal of ICNs is expected in the late stages of construction. During the Demonstration, WEC evaluated this expected surge. Because it is the result of the construction sequence, the surge cannot be reduced without significantly revising the ITAAC. WEC based the evaluation on a two-unit site, similar to Vogtle Units 3 and 4, and identified two waves, the first arriving 11–13 months before fuel load (approximately 260 ICNs per unit expected) and the second occurring 1–7 months before fuel load (approximately 249 ICNs per unit expected). Surge mitigation strategies may reduce the first wave by about 25 percent through scheduling improvements, but minimal

improvement areas have been identified for the second wave, which consists of many reference ITAAC [ITAAC completed as part of another ITAAC] and preoperational tests. Reference ITAAC should not require significant effort to close, and preoperational tests have a well understood process with a high level of NRC inspector involvement, which should further facilitate ITAAC closure. A focus on streamlining ITAAC completion and subsequent staff verification should have the greatest impact on minimizing unnecessary delays.

Section 4.1 of this report discusses the key next steps, identified through the public workshops and agreed to by Demonstration participants as the best way to improve the management of the expected ITAAC surge. Industry will continue to enhance strategies to mitigate the surge in ICN submittal.

4.0 Proposed Next Steps

Based on the lessons learned from the Demonstration, the NRC and the industry have proposed a series of next steps. These steps are important actions, as identification of lessons learned alone has limited value.

4.1 Key Next Steps

The key next steps, as indicated below, are the most important steps resulting from the Demonstration.

4.1.1 Develop Additional ICN Examples for NEI 08-01 and RG 1.215

As stated previously in Section 3.4.2, development of additional ICN examples for NEI 08-01 would be useful to ensure an efficient review. This would also provide more certainty to the ICN review process to help manage the expected ITAAC surge. To accomplish this next step, the NRO staff proposed a categorization methodology, grouping ITAAC with similar attributes from the AP1000 design control document (DCD) population. The staff has identified 27 groups and proposes development of additional examples for each group to provide a larger representative sample of all ITAAC from the design. NEI, with the industry, will develop an ICN for each ITAAC included in the representative selection and submit them to the staff for review. Once reviewed by the staff, the industry will then revise NEI 08-01 appropriately to include these additional 27 ICN examples, along with the four ICN examples developed during the Demonstration. These 31 new examples will serve as an additional resource for licensees to reference as ICNs are drafted. Concurrent with these changes, the industry will enhance NEI 08-01 guidance to facilitate development of ICNs. Such enhancements will include (1) instructions on how to prepare ICNs using the template and examples and (2) the previously mentioned ICN examples. NRO expects to have sufficient resources to support this effort, which will be coordinated through the regularly scheduled public meetings for the Construction Inspection Program. The revised NEI 08-01 will be endorsed in the next revision to RG 1.215.

4.1.2 NRC Review of the Uncompleted ITAAC Notifications (225-day letters)

Section 10 CFR 52.99(c)(2) states, in part, that the licensee shall notify the NRC that the prescribed ITA for all uncompleted ITAAC will be performed and that the prescribed AC will be met before operation. The notification must be provided no later than the date 225 days before the scheduled date for initial loading of fuel and must contain sufficient information to demonstrate that the ITAAC will be successfully completed, including, but not limited to, a description of the specific procedures and analytical methods to be used for performing the prescribed ITA and determining that the prescribed AC will be met.

During the Demonstration, the industry proposed that the NRC review and provide comments on the 225-day letters as a potential surge mitigation strategy. An NRC review of these letters may allow for early identification of problems embedded in the proposed ICN determination basis. Feedback on the letters will serve as advanced feedback on the ICNs. The NRC will review some of these letters and, based on the value gained from the reviews, will determine if additional letter reviews will be beneficial. This effort will be developed through the regularly scheduled public meetings for the Construction Inspection Program and will be incorporated into the draft ICVP office instruction

4.2 Office Instruction Development

The development of two office instructions, as indicated below, are currently underway and will incorporate lessons learned and knowledge gained during the Demonstration.

4.2.1 ITAAC Closure Verification Process Office Instruction

The Demonstration exercised the draft ICVP office instruction, which serves as a tool for NRO reactor operation engineers when verifying ITAAC closure. The office instruction contains a detailed narrative of instructions, a process flowchart, and a verification evaluation form. The evaluation form, which was developed during the Demonstration, contains specific yes or no criteria that must be met to verify closure of the ITAAC. Also developed during the Demonstration was a second evaluation form, for referencing in the FRN, to document the basis for staff's determination. In utilizing the two evaluation forms, the staff found a significant overlap. Therefore, the staff merged all the information from the office instruction evaluation form and the FRN evaluation form into a new form that will be included in the ICVP office instruction and will be referenced as the determination basis document in the FRN. The NRC shared this verification evaluation form with the Demonstration participants during the public meetings.

4.2.2 10 CFR 52.103(g) Process Office Instruction

The Demonstration did not exercise the communication from the NRC staff to the Commission, as part of the 10 CFR 52.103(g) process, but identified it as a process that requires development in the form of an office instruction. Included in this office instruction is a SECY paper template for notifying the Commission that the staff has received all ICNs, has verified that all ITA were performed and all AC met, and is thereby recommending that the Commission find that the AC in the COL are met. Also being developed is a basis document that the staff

would provide to the Commission with the SECY paper, to provide the technical basis for its recommendation.

4.3 ITAAC Intent Resolution

Several of the ITAAC chosen for the Demonstration identified a disparity between the NRC staff and the industry participants in interpreting the ITAAC. Three types of ITAAC (functional arrangement, report, and D-RAP) were identified as having larger applicability, not only to the specific ITAAC chosen for the Demonstration but also to other design centers. By reviewing the additional ICN examples under development for NEI 08-01, as discussed in Section 4.1.1 of this report, the staff and industry may identify additional examples of ITAAC with “intent of wording” issues.

NRO reactor operations engineers have already provided three ITAAC training sessions for NRO technical reviewers for ITAAC quality and inspectability issues. Improving the initial technical review may help to ensure that future ITAAC are written with the required clarity, thus alleviating any issues regarding intent during ITAAC closure and verification.

4.3.1 Functional Arrangement

During the Demonstration, an as-built functional arrangement ITAAC was included. The ICN stated, in part, “the components were validated to be in locations as provided in both Table 2.2.2-4 of Tier 1 of the DCD and Figure 2.2.2-1.” The NRC staff questioned the efficacy of completing the functional arrangement ITAAC in this manner and raised several points with the industry, including (1) the incompleteness of the information on the Tier 1 figures for inspection purposes, as noted in prior SECY papers, (2) reference in the ITAAC to the entire design description, and (3) the Tier 1 definition of functional arrangement. The NRC staff, based on the functional arrangement definition and the ITAAC’s reference to the entire design description, contended that the as-built functional arrangement inspection requires (1) verification that the physical arrangement of systems and components is consistent with the final system design and (2) a system walkdown to confirm that all systems and components necessary to support the system function have been installed in the as-built system, irrespective of whether they are included in the referenced figures and tables. However, the industry maintained that the ITAAC only requires verification of compliance with the locations specified in Table 2.2.2-4 and the certified partial piping and instrumentation diagram (i.e., Figure 2.2.2-1).

Demonstration participants agree that further clarification and guidance should be added to NEI 08-01 regarding functional arrangement ITAAC. The staff is working internally to reach resolution on the proper interpretation of functional arrangement ITAAC.

4.3.2 Report ITAAC

The Demonstration included a report ITAAC. ICNs do not include these reports, but the reports are referenced as part of the completion packages and are available for staff inspection if necessary. As part of the Demonstration, the reports were inspected onsite and showed a

significant difference in the expected level of detail they included. Investigation across other design centers identified inconsistencies on the usage and scope of report ITAAC.

This issue remains unresolved and continued dialogue at public workshops with the industry is needed to clarify the remaining issues. The staff has developed draft inspection strategy documents as well as an interim staff guidance to provide instruction on how to inspect “report” ITAAC.

4.3.3 D-RAP

The Demonstration included a D-RAP ITAAC. The wording of the ITAAC was changed in a recent revision of the AP1000 DCD and, although this had been reflected in updated NEI guidance, the ICN was prepared in accordance with a template that has now been superseded. The staff pointed out that the analysis that had been performed was no longer an acceptable basis for the closure of the recently revised ITAAC. Inspectors also reviewed design documents related to D-RAP activities for safety-related and nonsafety-related structures, systems, and components (SSCs) within the scope of the reliability assurance program. They confirmed that appropriate design inputs were identified and the design documents were reviewed and approved by the appropriate technical staff.

At a subsequent public meeting, a revised ICN was presented and discussed. The issue has been resolved for the purposes of the Demonstration. However, the staff noted that other design centers have D-RAP ITAAC that are worded differently, such that a different approach to ITAAC closure may be required.

An additional concern was that NRC staff engineering design verification inspections may overlap efforts to confirm completion of D-RAP ITAAC. The staff agreed that a satisfactory engineering design verification for a given SSC would obviate any need for the staff to evaluate associated design products for D-RAP ITAAC.

5.0 Conclusion

This Demonstration was extremely valuable for both the NRC and industry participants. Many aspects of the ITAAC closure and verification processes were exercised, and nearly every step resulted in lessons learned for both the industry and the staff, identifying areas for refinement. Actions taken now will better prepare the industry and the NRC for future closure activities related to new nuclear power plant construction. The lessons learned from the Demonstration have already resulted in many valuable changes and refinements. The key next steps, (1) develop additional ICN examples for NEI 08-01 and RG 1.215, and (2) an NRC review of the uncompleted ITAAC notifications, highlight what participants identified as the most important, immediate actions for both the NRC and industry. Other next steps, including associated office instruction development and ITAAC intent resolution, are important issues and tasks to be completed in the near term.

6.0 Demonstration ITAAC

The Demonstration originally included the five ITAAC listed below from (1) to (5) from the AP1000, Revision 17 Application. These ITAAC were chosen to provide variety in complexity, scope, vendor inspection, and targeting. At the request of the industry, the sixth ITAAC, Design Reliability Assurance Program (D-RAP), was added after the Demonstration started because of its unique nature. These six ITAAC are listed below.

(1) ITAAC 2.1 02.07a.i—The Reactor Coolant System (RCS) Harsh Environment Type Test

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
7.a) The Class 1E equipment identified in Table 2.1.2-1 as being qualified for a harsh environment can withstand the environmental conditions that would exist before, during, and following a design-basis accident without loss of safety function for the time required to perform the safety function.	i.) Type tests, analyses, or a combination of type tests and analyses will be performed on Class 1E equipment located in a harsh environment.	i.) A report exists and concludes that the Class 1E equipment identified in Table 2.1.2-1 as being qualified for a harsh environment can withstand the environmental conditions that would exist before, during, and following a design-basis accident without loss of safety function for the time required to perform the safety function.

(2) ITAAC 2.2 01.04a.ii—Containment System Impact Testing

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
4.a) The components identified in Table 2.2.1-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.	ii) Impact testing will be performed on the containment and pressure-retaining penetration materials in accordance with the ASME Code Section III, Subsection NE, to confirm the fracture toughness of the materials.	ii) A report exists and concludes that the containment and pressure-retaining penetration materials conform with fracture toughness requirements of the ASME Code Section III.

(3) ITAAC 2.2 02.01—Passive Containment Cooling Function Arrangement

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
1) The functional arrangement of the PCS is as described in the Design Description of this Section 2.2.2.	Inspection of the as-built system will be performed.	The as-built PCS conforms to the functional arrangement as described in the Design Description of this Section 2.2.2

(4) ITAAC 2.2 03.08c.i—Injection Line Flow Resistance Testing and Analysis

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
<p>8.c) The PXS provides RCS makeup, boration, and safety injection during design-basis events.</p>	<p>i) A low-pressure injection test and analysis for each CMT, each accumulator, each IRWST injection line, and each containment recirculation line will be conducted. Each test is initiated by opening isolation valve(s) in the line being tested. Test fixtures may be used to simulate squib valves.</p> <p>CMTs: Each CMT will be initially filled with water. All valves in these lines will be open during the test.</p> <p>Accumulators: Each accumulator will be partially filled with water and pressurized with nitrogen. All valves in these lines will be open during the test. Sufficient flow will be provided to fully open the check valves.</p> <p>IRWST Injection: The IRWST will be partially filled with water. All valves in these lines will be open during the test. Sufficient flow will be provided to fully open the check valves.</p> <p>Containment Recirculation: A temporary water supply will be connected to the recirculation lines. All valves in these lines will be open during the test. Sufficient flow will be provided to fully open the check valves.</p>	<p>i) The injection line flow resistance from each source is as follows:</p> <p>CMTs: The calculated flow resistance between each CMT and the reactor vessel is $\geq 1.81 \times 10^{-5} \text{ ft/gpm}^2$ and $\leq 2.25 \times 10^{-5} \text{ ft/gpm}^2$.</p> <p>Accumulators: The calculated flow resistance between each accumulator and the reactor vessel is $\geq 1.47 \times 10^{-5} \text{ ft/gpm}^2$ and $\leq 1.83 \times 10^{-5} \text{ ft/gpm}^2$.</p> <p>IRWST Injection: The calculated flow resistance for each IRWST injection line between the IRWST and the reactor vessel is: Line A: $\geq 5.53 \times 10^{-6} \text{ ft/gpm}^2$ and $\leq 9.20 \times 10^{-6} \text{ ft/gpm}^2$ and Line B: $\geq 6.21 \times 10^{-6} \text{ ft/gpm}^2$ and $\leq 1.03 \times 10^{-5} \text{ ft/gpm}^2$.</p> <p>Containment Recirculation: The calculated flow resistance for each containment recirculation line between the containment and the reactor vessel is: Line A: $\leq 1.11 \times 10^{-5} \text{ ft/gpm}^2$ and Line B: $\leq 1.04 \times 10^{-5} \text{ ft/gpm}^2$.</p>

(5) ITAAC 2.6 03.08—DC System Fault Current Analysis

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
<p>8) Circuit breakers and fuses in IDS battery, battery charger, dc distribution panel, and MCC circuits are rated to interrupt fault currents.</p>	<p>Analyses for the as-built IDS dc electrical distribution system to determine fault currents will be performed.</p>	<p>Analyses for the as-built IDS dc electrical distribution system exist and conclude that the analyzed fault currents do not exceed the interrupt capacity of circuit breakers and fuses in the battery, battery charger, dc distribution panel, and MCC circuits, as determined by their nameplate ratings</p>

(6) ITAAC 3.7 00.01—Design Reliability Assurance Program (D-RAP)

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
<p>1) The D-RAP provides reasonable assurance that the design of risk-significant SSCs is consistent with their risk analysis assumptions.</p>	<p>Inspection will be performed for the existence of a report which establishes the estimated reliability of as-built risk-significant SSCs.</p>	<p>A report exists and concludes that the estimated reliability of each as-built component identified in Table 3.7-1 is at least equal to the assumed reliability and that industry experience, including operations, maintenance, and monitoring activities, were assessed in estimating the reliability of these SSCs.</p> <p>For an as-built component with reliability less than the assumed reliability, an evaluation shall show that the net effect of as-built component reliabilities does not reduce the overall reliability. Or, an evaluation shall show that there is not a significant adverse effect on the core melt frequency or the large release frequency in the PRA applicable to the plant</p>

7.0 Acronyms and Abbreviations

AC	acceptance criteria
CFR	<i>Code of Federal Regulations</i>
CIPIMS	Construction Inspection Program Information Management System
COL	combined license
D-RAP	Design Reliability Assurance Program
DCD	design control document
Demonstration	Simulated ITAAC Closure and Verification Demonstration
DOE	U.S. Department of Energy
FRN	<i>Federal Register</i> notice
ICN	ITAAC closure notification
ICVP	ITAAC Closure Verification Process
IT	information technology
ITA	inspections, tests, and analyses
ITAAC	inspections, tests, analyses, and acceptance criteria
LWR	light-water reactor
NEI	Nuclear Energy Institute
NOV	notice of violation
NRC	U.S. Nuclear Regulatory Commission
NRO	Office of New Reactors
OGC	Office of the General Counsel
RG	regulatory guide
RII/CCI	NRC Region II Center for Construction Inspection
SNC	Southern Nuclear Company
SSCs	structures, systems, and components
TAR	technical assistance request
VOICES	Verification of ITAAC Closure, Evaluation, and Status
WEC	Westinghouse Electric Company