POLICY ISSUE
(Notation Vote)

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SECY-91-178

For: The Commissioners

From: James M. Taylor
Executive Director for Operations

Subject: INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA (ITAAC) FOR DESIGN CERTIFICATIONS AND COMBINED LICENSES

Purpose: To request Commission guidance on the form and content of ITAAC for a design certification rule and a combined license as required by 10 CFR Part 52.

Background: On May 18, 1989, 10 CFR Part 52 became effective. This rule provides for the issuance of early site permits, standard design certifications, and combined licenses for nuclear power plants. One goal of this rulemaking was to provide a process for the early resolution of safety issues. The staff has discussed the design information requirements for design certification in previous commission papers. On February 15, 1991, the Commission issued an SRM for SECY-90-377 that provided the staff with policy guidance on a number of issues related to 10 CFR Part 52, including ITAAC.

NOTE: TO BE MADE PUBLICLY AVAILABLE WHEN THE FINAL SRM IS MADE AVAILABLE

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Summary: This paper describes how the ITAAC for design certification, the ITAAC associated with site-specific design information, and the tier 2 validation attributes constitute a verification program that will be implemented by the combined license holder. The form and content of the ITAAC document is proposed with an example. The paper also describes how the successful completion of the ITAAC requirements and any other acceptance criteria in the combined license will constitute the basis for the NRC's determination to allow operation of the facility.

Discussion: The purpose of ITAAC is to verify that the as-built plant conforms to the approved plant design and that there is reasonable assurance that the plant will operate in conformity with the combined license, the Atomic Energy Act, and applicable regulations. The requirement to provide ITAAC for a design certification application is set forth in section 52.47(a)(1)(vi). The requirement to provide ITAAC for a combined license application is set forth in section 52.79(c). If the applicant for a combined license references a certified design, then the application must adopt the ITAAC for the certified portion of the design.

Although the two sections of the rule cited above are applicable to different stages in the Part 52 process, their basic intent is the same. Both sections require that the applicant propose a set of ITAAC (verification activities) that will demonstrate that the facility has been properly constructed in accordance with the design and will operate in conformity with applicable requirements. The use of verification activities is not unique to the Part 52 licensing process. In the 10 CFR Part 50 licensing process, the applicant (and later the license holder) was required by regulation, license condition, and final safety analysis report commitments to perform a wide range of tests and inspections before the NRC issued a full power license. What is new, however, is that under the Part 52 process these verification activities and their associated acceptance criteria will be specified in the design certification rule, and later the combined license. The benefits to the early designation of these verification requirements include an up-front agreement to requirements and acceptance criteria, and the consolidation of requirements into a single document prior to commencement of construction activities.

The verification requirements (ITAAC) associated with a specific facility will be generated in a two step process. First, the ITAAC that are included in the certified design application

and published as part of the certified design rule will address the verification activities associated with the vendor's design submittal. Then, a combined license applicant will supply the site-specific design information and the verification requirements associated with that portion of the design. The ITAAC at combined license issuance (COL ITAAC) will consist of the combination of the certified design ITAAC plus the ITAAC associated with site-specific design information. The COL ITAAC will be incorporated into the combined license in a manner similar to the way technical specifications are incorporated into licenses under the Part 50 licensing process. Because vendor design-related verification requirements will appear in a certified design rule, a combined license applicant that desires to propose alternate vendor design-related verification activities or acceptance criteria may request an exemption under 52.63(b). The site-specific design-related verification activities specified in the COL ITAAC can be modified through an NRC-approved license amendment following issuance of the combined license.

Just as a two-tiered approach is being adopted for vendor design information in accordance with SECY 90-377, "Requirements for Design Certification under 10 CFR Part 52," the verification requirements associated with that design are also divided into two tiers. Tier 1 verification requirements will consist of those ITAAC that are specified in the certified design rule or the combined license. The staff expects that these requirements will be general in nature and will address the design at a system functional performance level of detail. Numeric acceptance criterion values will only be specified when failure to meet the stated acceptance criteria would clearly indicate a failure to properly implement the design. An example of a numeric acceptance criteria might be the minimum acceptable flow rate to the reactor vessel of an emergency core cooling system needed to support the safety analyses of the certified design. The tier 1 verification requirements will be at a level of detail corresponding to the tier 1 design information of the certified design rule. The staff does not believe that it will be necessary for every design element specified in the certified design rule to have a corresponding tier 1 verification requirement. The ITAAC portion of the design certification rule and combined license will specify the important design elements that are to be verified through inspections, tests, or analyses. Changes to these tier 1 verification requirements may be requested by the applicant or licensee under Section 52.63(b).

Supporting the body of tier 1 verification requirements (ITAAC) will be a more detailed set of tier 2 validation attributes. The validation attributes will consist of

physically measurable as-built data that will support the conclusions regarding the acceptability of the tier 1 requirements. The certified design applicant, and later the combined license applicant, will be required to submit a compilation of the validation attributes and their corresponding acceptance criteria prior to certified design rulemaking or combined license issuance. The combined license holder would be allowed to change tier 2 validation attributes and their associated acceptance criteria under a process similar to the Section 50.59 process.

The implementation of a construction verification program, including ITAAC, validation attributes, and other licensee QA/QC programs, is the responsibility of the combined license holder. The COL ITAAC constitutes those activities that are necessary and sufficient to provide reasonable assurance that, if the tests, inspections, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the Atomic Energy Act, and the Commission's regulations. Therefore, in accordance with Section 52.103(c), the successful completion of the COL ITAAC and other acceptance criteria in the combined license will constitute the basis for the NRC's determination to allow operation of the facility. Since power ascension testing cannot be performed until fuel loading and power operation are authorized, these tests will be conditions to the authorization to operate the facility.

The licensee's construction verification programs (including ITAAC) will be conducted as construction proceeds, up to the point of readiness for commercial operation. As portions of these programs are completed, the combined license holder will periodically submit completion reports to the NRC that document the licensee's review of the associated activities. These completion reports will document the basis by which the combined license holder assures the satisfactory completion of construction activities. At a minimum, completion reports will include the results of ITAAC requirements. After NRC review and acceptance of the completion reports, and completion of applicable NRC inspections, the NRC will publish in the Federal Register, in accordance with Section 52.99, notices of the successful completion of the tests, inspections, and analyses and satisfaction of the acceptance criteria. While there will be several notices regarding ITAAC, there will only be one federal register notice that provides an opportunity to file a petition which shows that one or more of the acceptance criteria in the combined license have not been met and, as a result, there is good cause to modify or prohibit operation.

The staff plans to include a sign-as-you-go process in the inspection program for combined license facilities. This program will be similar to the sign-as-you-go process that was tested during the later stages of Vogtle's construction and will be based on the COL ITAAC. There are significant benefits to the sign-as-you-go process including an early common understanding of commitments, the sequential acceptance of major construction activities, the early identification and resolution of deficiencies, and the more timely resolution of unresolved inspection findings. An assessment of the Vogtle experience can be found in NUREG-1278, "Vogtle Unit 1 Readiness Review." The readiness review program was found to be an overall success but the concept could not be fully evaluated since construction of Vogtle Unit 1 was 75 percent complete at the time of program initiation. The current NRC inspection program would require modification to incorporate the sign-as-you-go concept.

The COL ITAAC requirements will serve as a facility lifetime commitment. After completing a major plant system modification, portions of the original tests, inspections, or analyses applicable to that system would be re-performed to demonstrate the acceptability of the modification. Therefore, the licensee will be expected to maintain a current COL ITAAC document in their offices throughout plant life. Once completion of ITAAC and the supporting validation attributes demonstrate that the facility has been properly constructed, it then becomes the function of existing traditional programs such as technical specifications, in-service inspection, and in-service test, to demonstrate that the facility continues to operate in accordance with the certified design and the license. Nevertheless, the COL ITAAC will remain in effect throughout the plant life to assure that the plant remains faithful to the design.

FORM AND CONTENT

The staff has developed a proposed outline of the design certification ITAAC document (at design certification rulemaking) and for the combined license ITAAC (at combined license issuance). Enclosure 1 is an abbreviated version of what would be included in the table of contents. The proposed document contains three major technical sections each of which consists of a number of individual modules.

Generic and Discipline Requirements

The first technical section includes modules which have requirements applicable to construction disciplines or activities which span more than one system or area in the

plant. Examples of modules in this section include soils and foundations, welding, pipe supports, concrete, and instrumentation. It is in this section that the applicant would propose general commitments such as codes and standards, and regulatory guides, and a method for verifying proper construction for each major discipline of plant construction. This section will ensure consistency of construction and verification activities across all important systems and structures for a given discipline. For example, the instrumentation module will provide verification requirements for instrumentation contained in all systems covered by ITAAC. Generic acceptance criteria will also be specified in this first technical section. For example, if there were to be a verification requirement and acceptance criterion associated with all instrumentation tubing slope then that minimum slope value could appear in this generic requirement section. However, acceptance criteria that are unique to a specific application would appear in the second technical section which addresses specific components, systems and structures.

Specific Component, System, and Structure Requirements

The second technical section provides the verification requirements for specific components, systems, and structures. Each module in this section provides the functional performance requirements as well as any unique discipline-related requirements associated with specific systems, components, or structures. Each module in this section includes the following parts: (1) list of applicable Section II modules, (2) list of essential design features to be verified, (3) list of the required inspections, tests, and analyses not already required by the generic and discipline modules, and (4) the acceptance criteria for the verification requirements in (3). Part (1) does not impose new verification requirements but simply refers back to the applicable generic and discipline modules in the first technical section. For example, the residual heat removal system (RHR) module would reference numerous generic modules including pipe supports, instrumentation, and welding. Before concluding that the RHR system was properly constructed, the combined license holder would verify that the commitments and requirements of the pipe supports, instrumentation, and welding generic modules were satisfied. Part (2) is simply a brief narrative description of the essential design elements of the system, component, or structure that can be verified through inspections, tests, or analyses. Parts (3) and (4) list the actual verification requirements and the associated acceptance criteria. Part (3) will contain a general description of the tier 1 ITAAC that the licensee will use to demonstrate that construction has

been properly completed. For example, this part would contain a description of the test methodology used to verify the capability to reach rated flow within the specified time. This does not mean that the entire test procedure needs to be included in the applicant's submittal. While the acceptance criteria's level of detail and numeric specificity have not been finalized, the staff anticipates that functional performance criteria of the type found in technical specifications would be appropriate. An example of the verification requirements for a BWR-4 high pressure coolant (HPCI) system has been prepared for illustrative purposes and is provided as Enclosure 2. The example does not cover the full scope of the HPCI system and may not be technically accurate regarding specific acceptance criteria values, but it does provide an indication of the type of information and acceptance criteria to be found in the ITAAC documents. This matter will be the subject of future discussions with the industry.

Safety Analyses Verification

The third technical section provides the verification requirements for safety analyses that support the facility's design. This section contains modules that provide the following: (1) a list of applicable modules from the second technical section, (2) a list of essential information used in the analysis to be verified, and (3) acceptance criteria. This section will not introduce any additional tests or inspections, but will serve to compile and document the verification of those input parameters that are vital to the analyses and have been verified through the modules in the previous two sections. The safety analyses verification section will include two types of essential information and acceptance criteria: (1) requirements and criteria for "safety analysis" results, such as peak pressures, thermal performance, and dose limits and (2) a limited set of critical system performance parameters to be met, such as valve closure times, and safety system flow rates. The safety analyses reviewed during the initial design review demonstrate that the safety performance acceptance criteria are satisfied when certain design input assumptions are made. This section provides verification that the original assumptions are still valid for the as-built facility. The design assumptions to be verified include those parameters associated with the as-built facility construction that can be verified through inspections or tests. The ITAAC will not include parameters which are controllable during operation, such as reactor coolant system temperature, flow, and pressure since they are expected to be maintained within safety analysis limits by Technical Specifications and

operating procedures. For the majority of the design assumptions, it is acceptable to show that the as-built data are enveloped by the design assumptions or to reevaluate the safety analysis with the as-built values and show that the results still satisfy the analysis acceptance criteria. However, if the as-built values for certain assumptions are not within the envelope of the design safety analysis, it may indicate inadequate construction. Therefore the ITAAC document would explicitly list these critical parameters.

Additional Areas Under Review:

The staff is evaluating a number of issues related to 10 CFR Part 52. The staff plans to bring the following issues to the attention of the Commission: (1) the relationship between the design certification rule and the combined license that references that rule, (2) the necessity to include ITAAC in Final Design Approvals (FDAs), and (3) the form and content of a design certification rule.

(1) The staff is evaluating if technical agreement between the rule and the license is required after the combined license is issued. To require consistency between the two would foster standardization between the subject facility and all others referencing that certified design. However, such a requirement might also require the NRC to evaluate all license amendments to determine if the certified design rule was impacted which could lead to rulemaking or exemption requests.

(2) The staff is also evaluating whether ITAAC is required to be included in a final design approval (FDA). The industry has proposed that FDA issuance is not conditioned upon NRC acceptance of the proposed ITAAC, nor is ITAAC required to be included in the FDA. 10 CFR 52 requires that ITAAC be included in an FDA application, but it is silent on inclusion in the FDA itself.

The staff will continue to provide separate policy papers to the Commission on 10 CFR Part 52 related topics in the future.

Coordination: The Office of the General Counsel has reviewed this paper and has no legal objection to its contents.

Recommendation: That the Commission: (1) endorse the staff's proposals for the combined verification program, (2) support the staff's continuing interaction with industry on this subject, and (3) make this paper publicly available.

James M. Taylor
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for Operations

Enclosure:
1. Sample table of contents for ITAAC
2. Sample ITAAC for a BWR-4 High Pressure Coolant Injection System (HPCI)

Commissioners' comments or consent should be provided directly to the Office of the Secretary by COB Thursday, June 27, 1991.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT Thursday, June 20, 1991, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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ENCLOSURE 1

INSPECTIONS, TESTS, ANALYSES AND ACCEPTANCE CRITERIA

(ITAAC)

CONTENTS

SAMPLE ITAAC FOR A BWR-4 HIGH PRESSURE COOLANT INJECTION SYSTEM (HPCI)

This enclosure provides an example of the verification requirements for specific components, systems, and structures that would be found in the ITAAC document at the time of design certification. A BWR-4 high pressure coolant injection (HPCI) system was arbitrarily selected. This example was developed for illustrative purposes only, does not address all aspects of the HPCI system, and numeric values may not be technically accurate. However, it does provide an indication of the expected content in the ITAAC portion of the certified design rule.

1. Listing of Generic and Discipline Modules

The combined license holder will verify proper construction of portions of the HPCI system through completion of the appropriate generic and discipline requirements found in the first technical section of the ITAAC document. The combined license holder will document satisfactory completion of these verification requirements through the construction quality assurance program and the module completion reports. The applicable generic and discipline modules include:

Major equipment supports
Mechanical components
Piping and pipe supports
Instrumentation
Welding
Electrical connections

2. Essential Design Features

The design features listed below constitute the essential attributes of the HPCI system as described in the certified design rule that will be verified though the performance of inspections, tests, and analyses.

A. System is capable of auto-starting and reaching rated flows within specified time of receipt of signals.

B. System can deliver specified flow rates with desired split between core spray sparger and feedwater sparger.

C. System can be remote manually started and controlled.

D. System has immediately available suction supply of reactor grade water, with capability for auto-transfer to alternate supply.

E. System can start and operate with no AC power available.

F. System can automatically start and run without need for operator intervention.

G. System is automatically tripped and/or isolated when conditions exist that could damage the HPCI system.

3. Inspections, Tests, and Analysis (ITA)

Tests will be performed that will demonstrate the operability of the HPCI system during reactor vessel injection while at rated reactor pressure. Proper system response will be verified in the automatic and manual mode. A series of tests will be conducted at a reactor power level of greater than 50 percent that will demonstrate that the HPCI system meets the acceptance criteria associated with the essential design features.

4. Acceptance Criteria

A.1 The average pump discharge flow must be equal to or greater than 5600 gpm prior to exceeding 27 seconds from automatic initiation at any reactor pressure between 200 psig and rated.

A.2 The HPCI turbine shall not trip or isolate during the automatic or manual start tests.

A.3 HPCI turbine speed peaks shall not be greater than 5 percent above the rated HPCI turbine speed.

B. System can deliver flow into vessel with 2000-3000 gpm through the CS sparger and 2600-3600 gpm to feedwater sparger (with reactor pressure between 200 psig and rated).

C. System will start, operate, and shutdown when controlled from the control room within flow limits noted above, with minimum shift staffing levels.

D. System suction automatically shifts from CST to suppression pool upon detection of either low CST level (value) or high pool level (value) without isolation of HPCI due to loss of suction to pump.

E. System starts and runs for two hours after initiation with no ac power sources available.

F. HPCI turbine does not trip and system does not isolate during starting. HPCI turbine control or flow controls do not require adjustment for at least ten minutes after starting of system.

G. HPCI turbine trips and system isolates upon receipt of signals of: turbine overspeed, high vessel level, low pump suction pressure, and turbine exhaust high pressure.

Note: Validation attributes will not be specific in the ITAAC portion of the design certification rule, but the combined license holder will be required to submit the validation attributes and acceptance criteria as part of the application for design certification. The staff expects the following types of information to be included in validation attributes.

- Pump head/flow curve over range of pressures
- Verification of stroking of individual valves (steam supply, injection) in response to actuation signals
- Verification of interlock setpoints
- Verification of jockey pump capacity to fill discharge lines
- Response characteristics of turbine control and flow controller
- Verification of operation of barometric condenser components
- Functioning of freeze protection features
- Response of instrumentation, control room alarms, etc.