# ITAAC Solution for APR1400 NRC Design Certification

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## 1. Introduction

ITAAC (Inspections, Tests, Analyses & Acceptance Criteria) is essential document for Design Certification, which is certified by NRC and ruled as the Appendix of the 10 CFR Part 52. Because all the nuclear plants we have were licensed pursuant to the 10 CFR Part 50, ITAAC is not familiar to us. Other competitive reactors like US-APWR, ESBWR, AP1000 have been spending lots of time and manpower to complete ITAAC for their design certification from NRC. In this paper, the regulatory basis and ITACC solution are discussed to seek the way to complete the best ITAAC to get the Design Certification of APR1400 from NRC with lessons learned from other competitive applicants.

## 2. ITAAC Principles

### *2.1 Regulatory basis*

Design control document (DCD) is partitioned into two tiers of information: the certified design material (Tier 1) and the approved design material (Tier 2). Tier 1 consists of design description (DD) and inspections, tests, analyses and acceptance criteria (ITACC) required by 10CFR52.47(b)1. The primary intent of the ITAAC is to verify that the as-built plant on the final site has been constructed and should perform in accordance with the design certification and applicable regulations. Thus, many ITAAC are anticipated to be met towards the end of facility construction and pre-operational testing. 10CFR52.47(b) requires that a DC application should contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance. If the inspections, tests, and analyses were performed and the acceptance criteria were met, a plant that incorporates the design certification could be built and should operate in accordance with the design certification, the provisions of the Atomic Energy Act and the NRC's regulations.

### *2.2 RG 1.206 & SRP (Standard Review Plan) 14.3*

RG 1.206 C.II.1 provides the specific ITAAC development guidance and organizational conformance with the Standard Review Plan (NUREG-0800).
The regulations contained in 10 CFR Part 52 include requirements for providing proposed ITAAC with an application for design certification in accordance with Subpart B to 10 CFR Part 52. In developing the guidance in this regulatory guide, the NRC staff also considered the corresponding interface with the SRP. That is, the staff will review the guidance provided herein, regarding information that a COL applicant must submit to the NRC, in accordance with the SRP to assess compliance with the applicable regulations. To better facilitate the interface between this regulatory guide and the SRP, the staff has organized the specific guidance for developing ITAAC in the same manner as the SRP. That is, SRP Section 14.3 provides introductory and general guidance for the following associated SRP sections, which have been organized in accordance with the primary review responsibilities of the NRC's technical staff branches:

- SRP Section 14.3.1 Site Parameters
- SRP Section 14.3.2 Structural & Systems Engineering
- SRP Section 14.3.3 Piping Systems and Components
- SRP Section 14.3.4 Reactor Systems
- SRP Section 14.3.5 Instrumentation and Controls
- SRP Section 14.3.6 Electrical Systems
- SRP Section 14.3.7 Plant Systems
- SRP Section 14.3.8 Radiation Protection
- SRP Section 14.3.9 Human Factors Engineering
- SRP Section 14.3.10 Emergency Planning
- SRP Section 14.3.11 Containment Systems
- SRP Section 14.3.12 Physical Security Hardware

### *2.3 ITAAC Tabular Format and Content*

A three-column format for ITAAC is acceptable, as discussed below. Column 1 - Design Commitments: This column contains the text for the specific design commitment that is extracted from the design descriptions. Any differences in text should be minimized, unless intentional. Column 2 - Inspections, Tests, and Analyses: This column contains the specific method to be used by the licensee to demonstrate that the design commitment in Column 1 has been met. The method is either by inspection, test, or analysis or some combination of these. Column 3 - Acceptance Criteria: This column contains the specific acceptance criteria for the inspections, tests, or analyses described in Column 2 which, if met, demonstrate that the design commitments in Column 1 have been met.

Table C.II.1-1 Sample ITAAC Format

| Design Commitment | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|
| 1. The basic configuration of the _____ system is as shown in Figure ___. (If a figure is not used, reference the section number.) | 1. Inspections of the as-built system will be conducted. | 1. The as-built _____ system conforms with the basic configuration shown in Figure __. |
| 2. The ASME Code components of the ____ system retain their pressure boundary integrity under internal pressures that will be experienced during service. | 2. A hydrostatic test will be conducted on those components of the ___ system required to be hydrostatically tested by the ASME Code. (Note 1) Preoperational NDE will be conducted on those | 2. The results of the hydrostatic test of the ASME Code components of the ____ system conform with the requirements in Section III of the ASME Code. (Note 1) |

## 3. ITAAC Solution

### *3.1 Selection of Design Commitments*

AS mentioned above, because ITAAC is the rule, it is not available to change or modify that after certified. So the selection of design commitment is very important from the first to make ITAAC. For US-APWR, 1003 ITAAC are counted. The number of APR1400 ITAAC for SKN 3, 4 is 667, which was developed on the basis of System 80+ certified by NRS in 1997. The deviation of two design has happened due to the fact that US-APWR reflected the new RG 1.206 for its DC, but System 80+ didn't.

To save the time for selection of ITAAC, it needs to analyze and make database of APR1400 and US-APWR ITAAC. To make the basis ITAAC of APR1400 DC easier, items of US-APWR ITAAC excluded its own unique design can be added using the analysis database. Then, the basis ITAAC for APR1400 NRC DC pursuant to RG 1.206 can be made. The level of detail of AP1000 certified design by NRC recently also can be a reference to APR1400 ITAAC.

### *3.2 ITAAC V&V (Validation & Verification)*

To complete the final ITAAC of APR1400 DC, several aspects should be reviewed. Testability, acceptability, pursuit of RG 1.206 and SRP 14 of ITAAC must be checked. For the review and check process, ITAAC V&V table can be a useful method. From the first step, system designers should fill out the V&V table which is required to check the suitability of the ITAAC of APR1400.

| ITAAC No. | ITA Stage | AC | Closing Document | Document No. | Document Title | APR1400 Comparison | US-APWR comparison | Final Acceptability |
|---|---|---|---|---|---|---|---|---|
| 1 | construction | satisfied | piping install procedure | walk down | | same | U2.4.5_1.b | accept |
| 2 | startup | no test | procedure | 4P-C-441-04<br>4P-H-441-02 | | same | U2.4.5_8.a.i | check more |
| 3 | fabrication | not satisfied | calculation report | | | added one | APR1400 unique design | not accept |

<ITAAC V&V Table sample>

The table requires each ITAAC's testability, test methods, test stage, closing document or reports, procedure title, comparison with US-APWR and final acceptability. The result of SKN 3, 4 In-Service Inspection implemented by KINS must be cross checked to finalize the ITAAC of APR1400 NRC DC.

## 4. Conclusions

For saving the time and manpower to complete ITAAC of APR1400 NRC DC and reduce the RAIs (Request Additional Information) from NRC, it needs to take advantage of the lessons learned through the trial and error of US-APWR design certification process. The analyzing database of APR1400 and US-APWR will be a useful method to select and decide the design commitments comparing each other. AP1000 ITAAC also can be a good reference to decide the level of detail for APR1400. ITAAC V&V (Validation & verification) table must be checked by system designers from the first step to select ITAAC. ITAAC document which is acceptable and pursuant to RG 1.206 should be submitted finally for design certification from NRC. Otherwise, NRC will issue great amount of RAIs to us. It takes lots of time and man hours to resolve RAIs. We have to keep in mind that RAI is money.

## REFERENCES

[1] US NRC, Regulatory Guide 1.206 Combined License Application for Nuclear Power Plant (LWR edition), 2007
[2] US NRC, 10 CFR 52 License Certification and Approvals for Nuclear Power Plant, 2009
[3] 'Inspections, Tests, Analyses, and Acceptance Criteria,' "Initial Test Program and ITAAC – Design Certification," Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants. SRP 14.3, 2007