

October 31, 2007

MEMORANDUM TO: Michael Gartman, Acting Chief
ESBWR/ABWR Project 2
Division of New Reactor Licensing

FROM: Ian Jung, Chief /RA/
Instrumentation, Controls and Electrical Engineering 2
Division of Engineering

SUBJECT: ACCEPTANCE REVIEW RESULTS FOR THE STP 3&4
COMBINED LICENSE APPLICATION (TAC NO. MD6848)

Instrumentation, Controls and Electrical Engineering 2 (ICE2) has completed its acceptance review of the STP 3&4 Combined License application (COLA) submitted by South Texas Project (STP). This review covered the following COLA FSAR Sections for which ICE2 has primary review responsibilities and, in addition, applicable interface documentation referenced in the FSAR:

FSAR Chapter 7

Referenced documentation

ABWR Design Control Document (DCD) Tier 1/2 Revision 4, T1 Section 3.4,
T2 Chapter 7

Completeness and Sufficiency

Based on this review, I conclude that the application does not contain all the information required by regulations. Additionally, there are significant gaps in the submitted information that preclude the conduct of an effective and efficient technical review and, therefore, preclude the development of a specific review schedule at this time. ICE2 cannot commence the STP 3&4 COLA detailed technical review without the issues resolved and information provided as discussed in the enclosures.

The significant technical deficiencies are as follows:

1. T1 3.4-1 safety related I&C architecture does not include adequate discussion on compliance with the current regulatory requirements.
2. T1 3.4-1 does not sufficiently describe the new aspects of the I&C architecture.
3. T1 3.4-1 does not provide the plans and schedule for implementation of the I&C Design Acceptance Criteria (DAC).

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Schedule

Once the issues are resolved and the information provided as discussed, the estimated effort for the detailed technical review of the STP 3&4 COLA SRP Sections by ICE2 is expected to be generally consistent with the current pre-baseline EPM model. The resource plan that currently exists in the EPM for these sections may be retained.

Review Dependencies.

ICE2's detailed technical review of the STP 3&4 COLA is dependent upon completion of the staff's ongoing review as identified in Enclosure 1.

- Enclosures:
1. Table 1 of the Safety Analysis Report Review Guide
 2. SAR Acceptance Review Results for STP 3&4 ABWR COLA
 3. STD DEP T1 3.4-1 Safety-Related I&C Architecture

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Table 1: Safety Analysis Report Acceptance Review Results for STP 3& 4 ABWR COLA

SER Section: 7.2.2 and 7.2.7. Technical Branch: ICE2 Technical Reviewer: Sang Rhow

Branch Chief: Ian Jung SRP Section: 7.1

Date: 10/23/2007

Does the section address the applicable regulations: No

Are there any technical deficiencies, changes in planning assumptions, or dependencies on concurrent reviews? Yes Identify specific review area/topic in table below.

1. Review Area/Topic*	Completeness and Technical Sufficiency Which Form Basis for Acceptability for Docketing				Changes to Planning Assumptions to be Considered in Development of Baseline Review Schedule			Review Dependencies Among Concurrent Reviews		
	2. Does COL section address the items required by regulation (refer to RG 1.206, Section C.IV.1)? (Yes/No)	3. Is COL section technically sufficient for this review area/ topic? (yes/no)**	4. Can the technical deficiency be resolved through the RAI process? (yes/no)***	5. If no, for either completeness or technical sufficiency, identify deficiency(ies). This information will be needed for technical review.	6. Is the identified technical deficiency related to a risk-significant SSC? (yes/no)****	7. Are the pre-baseline review schedule and estimated staff-hours appropriate? (yes/no)	8. For each no, identify the change (or basis for change).	9. Identify the total review time in staff-hours*****	10. Can the review of the area/topic be completed without the completion of a concurrent review? (yes/no)	11. For each no, identify which application (DCD or COLA) and section.
T1 3.4-1, Safety-Related I&C Architecture	Yes	No	No	10CFR50.55a(h)(2/3): Departure of T1 3.4-1 shall be justified based on IEEE 603-1991	Yes	Yes			No	7.9S (7.1, 7.2, 7.3, 7.4, 7.7, 7A)
STD DEP 7.1-1 Reference to Setpoint and Allowable Value	Yes	No	Yes	Based on 10CFR50.36(c)(1), the departure can be justified.	Yes	Yes			Yes	

*Review Area/Topic: Item identified in RG 1.206 or the regulations; for a COLA referencing a DC, this includes COL information items and departures from the design certification.

**Technical Sufficiency: The application is compared against the SRP acceptance criteria. Note: New safety features, alternate regulatory compliance approaches, and/or deviations from DCs, should not be treated as deficiencies and factored into the basis for rejecting the application, unless staff determines that there is insufficient technical information associated with the respective item. These items are factored into confirmation of planning assumptions.

***Significant deficiencies are those review area/topic which impact the staff's ability to begin the detailed technical review or complete its review within a predictable timeframe.

****DSRA will provide risk significance information at time of review, if available.

*****Identification of new review time is on a FSAR section basis and consistent with the review phases within the EPM. Changes from the pre-baseline review schedule and estimated hours should be on that basis.

Acceptance Review of STP 3&4 COLA Regarding Instrumentation and Controls

Ian Jung
ICE2/DE (DRAFT 10/23/2007)

Introduction

The combined license application (COLA) of STP 3&4 contains a significant number of changes from the certified design. According to the staff review, most of the changes meet the completeness and technical sufficiency that are expected of a COLA although the staff needs to request the applicant provide additional information on some of the changes. However, one significant departure (STP DEP T1 3.4-1 Safety-Related I&C Architecture), which requires NRC approval, is a significant concern for the staff from both the acceptance and COL review perspectives. This particular departure results in numerous changes to the Tier 1, Tier 2 and Tier 2* information as well as the relevant Design Acceptance Criteria. The changes are summarized as follows:

- Parts of the underlying technology used for the ABWR certified design instrumentation and controls are outdated and replaced with more modern, commercially available technology in the COLA. For example, the description of the hardware based Essential Multiplexing System (EMS), which supports the Safety System Logic Controls (SSLC) for Engineered Safety Features (ESF), is replaced with new function based terms or phrases, e.g., digital communication. The applicant states that "all of those basic requirements [of the ABWR DCD] are unaffected by the changes covered by this report, but in some cases the requirements are met with a different SSLC architecture." (Enclosure 3 is the COLA Description of the departure.)

Staff Issues

The key staff issues are that the STP 3&4 COLA:

- 1. Does not include adequate discussion on compliance with the current regulatory requirements.**

The proposed departure from the ABWR certified design voids the design finality of the affected portion of the certified ABWR design and requires the applicant to comply with the current regulatory requirements. According to 10 CFR 52.47, the staff expects that the applicant provide sufficient information regarding what regulatory requirements are affected and how such requirements are met stemming from the departure.

The ABWR I&C certified design was based on IEEE-279-1971 (per 10 CFR 50.55a) and associated staff acceptance criteria (per SRP). The staff determined

that the I&C certified design was in conformance with IEEE-603-1980, which was not a regulation but an industry standard.

STP 3&4 did not address how it complies with 10CFR 50.55a(h) for the departure, which incorporates IEEE-603-1991 by reference, nor did it fully address current applicable guidance described in SRP Chapter 7, Revision 5, March 2007. 10 CFR 52.79(a)(41) requires an evaluation of the facility against the Standard Review Plan (SRP) in effect 6 months before docketing.

The applicant's departure justification does not include any description on this subject; rather, it emphasizes how the departure does not affect the requirements of the certified design. The staff believes that the changes in Tier 1 and Tier 2 information are significant; therefore, the applicant is required to demonstrate compliance with the current regulation and to evaluate compliance with the revised SRP.

2. Does not sufficiently describe the new aspects of the I&C architecture.

The staff approval of the certified ABWR I&C design was based on a level of review regarding the I&C architecture, including the Essential Multiplexing System. With the absence of the detail of the new architecture, the staff may not be able to conclude that there is a reasonable assurance determination of safety in its safety evaluation report for the COLA.

The vagueness of the new technology, such as 'data communication function', can potentially become a difficult issue during the staff review of the COLA since the staff may not be able to determine its acceptability.

10 CFR 52.47 states, in part that "the application must contain a level of design information sufficient to enable the Commission to judge the applicants proposed means of assuring that construction conforms to the design and to reach a final conclusion on all safety questions associated with the design..." Without any design information associated with the new technology, the staff may not identify and resolve all safety questions.

The departure affects multiple SRP Chapter 7 Sections because the changes impact various I&C functions.

3. Does not provide the plan and schedule for implementation of the I&C Design Acceptance Criteria (DAC).

10 CFR Part 52 Section 52.63(a)(4), Finality of Standard Design Certifications, requires the COL application to provide the detailed design information necessary to resolve selected DAC. For I&C systems review, the I&C life cycle design process review is the most critical area for staff to make safety determination for a COL application. C.III.5.1 of RG 1.206 states that "[t]he NRC

staff recommends, to the greatest extent practicable, that the COL applicant include detailed design information in the areas where DAC were used in the design certification.”

STP 3&4 is not proposing to close any ITAAC/DAC; however, because the review effort for digital I&C systems life cycle design process is very extensive, the COL applicant should provide a realistic schedule for documentation submittal for the I&C DAC closure during the application phase such that the I&C review will not become the bottleneck of the plant fuel load. This is stated in C.III.5.1.1 where the staff recommends the COL applicant to “provide a schedule to the NRC as to when the information will be available for NRC review,” if it is not practical to submit sufficiently detailed information regarding DAC items.

Preliminary Conclusion

Based on the above, the staff finds that the STP 3&4 COLA does not contain all the information required by regulation and that the submitted information is not technically sufficient for ICE2 to commence the COLA detailed technical review.

Possible Success Path

- The applicant provides additional information addressing the staff's issues to supplement the COLA. Given the established I&C DAC process, the applicant may propose revision to ITAAC/DAC for staff approval to address the design incompleteness.

STD DEP T1 3.4-1 Safety-Related I&C Architecture

Description

This departure modifies the design of certain devices, functions and standards related to the Essential Multiplexing System (EMS) and Safety System Logic and Controls (SSLC). In general, this collection of changes enable the descriptions of the EMS and SSLC to be modified in such a way that they describe integrated top-level functions with a set of supporting subfunctions, as opposed to the current DCD descriptions, which describe them as separate systems with single-purpose hardware components.

The reference ABWR DCD design descriptions reflect outdated technology and are inconsistent with currently available systems and equipment. This change deletes references to components such as Control Multiplexing Units (CMUs), Remote Multiplexing Units (RMUs) and others that refer to an outdated technology (multiplexing), and imply hardware components (units) with limited purposes. In the text changes in FSAR chapter 7 and elsewhere, equivalent data communication functions are described, but not in the context of "multiplexing" or specific hardware components.

This departure also enables specific architecture changes in the Engineered Safety Functions (ESF) portion of the I&C architecture. Specifically, it limits the application of dual redundant Safety System Logic Units (SLUs) and 2-out-of-2 output voting only to those situations where the physical system arrangement and consequences of inadvertent actuation of equipment warrant such protection against inadvertent actuations. Also it eliminates SLU channel bypass function in this same portion of the structure. Also it allows the use of multiple processors where figures imply single processors.

This departure also deletes or supplements references to specific outdated communication protocol standards (both Tier 2 and Tier 2.) In the ten plus years that have passed since the reference ABWR DCD was finalized, network technologies have evolved to the point where the concepts and hardware described in the DCD are no longer available in modern, commercially available networks.*

At the time the GE ABWR was certified, the detailed design of the I&C equipment was not established. GE recognized that with the rapid evolution of the I&C technology, the preferred I&C design, including the design of equipment implementing the logic of ESF systems, would almost certainly include modules, components and capability not yet envisioned. Consequently, a specific equipment design for the SSLC systems was not established.

Even though no specific I&C equipment design was established for the ABWR, GE understood that the ABWR would make more extensive use of digital equipment than any previous plant design. GE developed a design of the SSLC and the supporting Essential Multiplexing System (EMS) using then current technology. These were structured as separate systems.

This generalized design, particularly for the EMS, was necessary to establish fundamental architectural elements, provides for the adequacy of diversity, and establishes a sufficiently comprehensive set of standards to be applied for the actual detail design. Specifically, such aspects as the system architecture constraints, system and software design processes, and equipment qualification requirements were established. These specific requirements relative to the I&C divisional architecture, inclusion of hardwired backups for diversity, specific design process related standards to be followed, and specific EMS redundancy requirements became the ABWR DCD. All of those basic requirements are unaffected by the changes covered by this report, but in some cases the requirements are met with a different SSLC architecture.

GE established the architecture for the ABWR for both the RPS and ESF portions of the SSLC based on NUMAC-type equipment. NUMAC-based I&C typically uses one NUMAC chassis per division for the system unless the total input/output count is too large, or the total computational load exceeds the capacity of the NUMAC chassis processing modules, or there is a specific need to maintain operability of part of the channel with equipment out of service. At that time, multiplexed processing of data was typically handled with somewhat independent "multiplexing systems". Based on implementation with NUMAC-type equipment, the potential loading for specific processors, and a separate multiplexing system, the design divided the SSLC into such sub-parts as digital trip modules (DTMs), trip logic units (TLUs), safety system logic units (SLUs) and remote multiplexing units (RMUs) and included a separate EMS. The design for ESF included pairs of SLUs in each division. In addition to the SSLC design, a design of the EMS was established based on the then-available methods and standards in the rapidly advancing area of multiplexing. The ABWR certified design was used to evaluate overall system issues and was the basis for PRA evaluations.

The DCD requirements included: 1) I&C divisions and system logic assignment; 2) divisions of sensors (typically all four divisions); 3) divisions of actuators (three divisions for ESF systems); and 4) EMS architecture having redundancy within each division. The ABWR supporting Tier 2 material also included the full safety design bases for all of the SSLC-related systems and a description of how the General Design Criteria (GDC) are satisfied. None of these requirements is affected by the changes covered by this departure.