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LTR-NRC-11-42

August 9, 2011

Subject: Responses to Requests for Additional Information on 6002-00301, CS Innovations' "Advanced Logic System Topical Report"

References:

1. NRC letter, A. L. Hon (NRC) to L. Erin (CS Innovations), Request for Additional Information, CS Innovations – Advanced Logic Systems Topical Report (TAC No. ME4454)

Reference 1 transmitted Requests for Additional Information (RAIs) regarding CS Innovations' "Advanced Logic System Topical Report." Responses to the RAIs are attached.

Correspondence with respect to the RAI responses should be addressed to:

Ms. Stephanie Smith
Westinghouse Electric Company
Nuclear Automation
5000 Ericson Drive
Warrendale, PA 15086

Very truly yours,

A handwritten signature in cursive script that reads "J. A. Gresham for".

J. A. Gresham, Manager
Regulatory Compliance

Cc: A. L. Hon (NRC OWFN 12 D20)
Attachment

TOD
NRC

Westinghouse Non-Proprietary Class 3

LTR-NRC-11-42
Attachment

Attachment to LTR-NRC-11-42

**Responses to Requests for Additional Information (RAIs) on 6002-00301, CS Innovations'
"Advanced Logic System Topical Report"
(IC-11-106)**



Westinghouse Electric Company
Nuclear Automation
5000 Ericsson Drive
Warrendale, PA 15086

To: File

Date: August 5, 2011

Reference 1: ADAMS ACCESSION NO.: ML1117517222

Letter No.: IC-11-106

Subject: Responses to Requests for Additional Information (RAIs) on the Advanced Logic System Topical Report, Document 6002-00301

This letter documents the Westinghouse responses to NRC requests for additional information on the Advanced Logic System Topical Report per Reference 1.

Question #1:

Describe how the combination of environmental conditions that are represented in the environmental profile of Advanced Logic System (ALS) EQ Plan (Section 5) and the ALS Topical Report (Section 4.1.1) and the limits identified in ALS Topical Report and the ALS Platform Requirements Specification (Section 9.1) sufficiently envelope the ALS Platform's susceptibility to synergistic effects from the proposed service conditions. This description should address Regulatory Guide 1.209 Regulatory Position 1 and Digital I&C-ISG-06 Section D.5.4.1.

Answer #1:

The ALS Platform follows the standard Westinghouse Equipment Qualification methodology for qualifying safety grade equipment as documented in the NRC approved WCAP-8587, revision 6-A. The postulated worst case abnormal temperature and humidity conditions are based on Table 6-1 (reproduced below) for equipment located outside of containment in mild environments. Figure 6-1 (reproduced below) also illustrates the abnormal temperature and humidity conditions. As required by Regulatory Guide 1.209, the test conditions will simulate the actual abnormal environments and durations given in the Table.

To address synergistic affects, the environmental conditions of temperature, humidity, voltage and frequency are applied simultaneously to the equipment under test. Performance of the equipment and its ability to perform its safety function are demonstrated under these extremes. Any additional synergistic effects resulting from future service conditions will have to be evaluated when they are made available.

Westinghouse Non-Proprietary Class 3

LTR-NRC-11-42
Attachment

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**Responses to Requests for Additional Information (RAIs) on 6002-00301, CS Innovations'
"Advanced Logic System Topical Report"
(IC-11-106)**



Westinghouse Electric Company
Nuclear Automation
5000 Ericsson Drive
Warrendale, PA 15086

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Date: August 5, 2011

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Subject: Responses to Requests for Additional Information (RAIs) on the Advanced Logic System Topical Report, Document 6002-00301

This letter documents the Westinghouse responses to NRC requests for additional information on the Advanced Logic System Topical Report per Reference 1.

Question #1:

Describe how the combination of environmental conditions that are represented in the environmental profile of Advanced Logic System (ALS) EQ Plan (Section 5) and the ALS Topical Report (Section 4.1.1) and the limits identified in ALS Topical Report and the ALS Platform Requirements Specification (Section 9.1) sufficiently envelope the ALS Platform's susceptibility to synergistic effects from the proposed service conditions. This description should address Regulatory Guide 1.209 Regulatory Position 1 and Digital I&C-ISG-06 Section D.5.4.1.

Answer #1:

The ALS Platform follows the standard Westinghouse Equipment Qualification methodology for qualifying safety grade equipment as documented in the NRC approved WCAP-8587, revision 6-A. The postulated worst case abnormal temperature and humidity conditions are based on Table 6-1 (reproduced below) for equipment located outside of containment in mild environments. Figure 6-1 (reproduced below) also illustrates the abnormal temperature and humidity conditions. As required by Regulatory Guide 1.209, the test conditions will simulate the actual abnormal environments and durations given in the Table.

To address synergistic affects, the environmental conditions of temperature, humidity, voltage and frequency are applied simultaneously to the equipment under test. Performance of the equipment and its ability to perform its safety function are demonstrated under these extremes. Any additional synergistic effects resulting from future service conditions will have to be evaluated when they are made available.

Qualification is performed to envelop the anticipated operating environments. The environmental requirements in the ALS Platform Requirement Specification are not the basis used to develop environmental qualification testing profiles.

TABLE 6-1

NORMAL AND ABNORMAL OPERATING ENVIRONMENTS

<u>General Area</u>	<u>Zone Description</u>	<u>Zone Code</u>	<u>Typical Areas</u>	<u>Range</u>	<u>Normal Operation</u>			<u>Abnormal Operation</u>			
					<u>Temp (°F)</u>	<u>RH (%)</u>	<u>Press. (psig)</u>	<u>Time Limit</u>	<u>Temp (°F)</u>	<u>RH (%)</u>	<u>Press. (psig)</u>
In-Containment	Inaccessible	IC/I	Inside Sec. Shield	Max	135	70	+0.3	8 hours	150	95	Atmos
				Min	65	20	-0.1		50	0	Atmos
	Accessible	IC/O	Outside Sec. Shield	Max	120	70	+0.3	=	120	95	Atmos
				Min	65	20	-0.1		50	0	Atmos
Out of Containment	Air ^(a) Conditioned	OC/A.C.	Control room, Aux Equip Room	Max	80	50	Atmos	12 hrs	82	95	Atmos
				Min	60	30	Atmos		40	0	Atmos
	Ventilated	OC/V	Aux building, Safeguards	Max	104	70	Atmos	12 hrs	120	35	Atmos
				Min	60	20	Atmos		40	0	Atmos
	Non-Ventilated	OC/NV	Turbine-Hall	Max	104	70	Atmos	=	120	35	Atmos
				Min	60	20	Atmos		40	0	Atmos

Note a: Abnormal operating parameters only apply for applications where Class 1E air conditioning systems are not supplied.

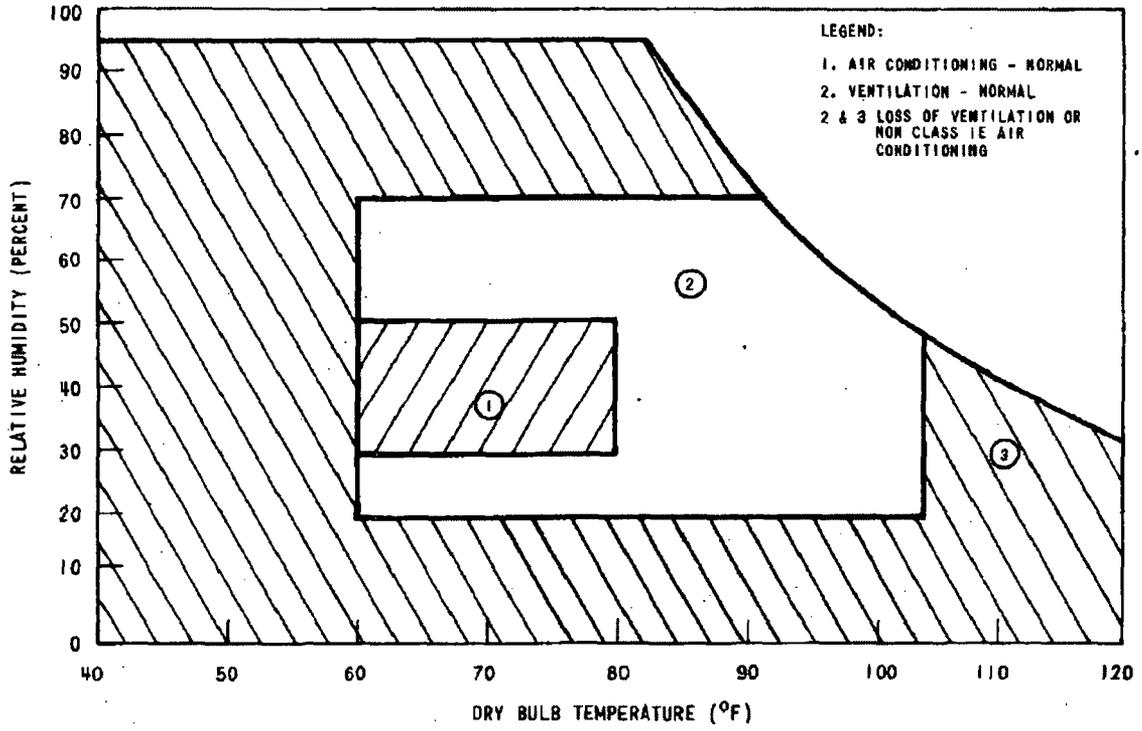


Figure 6-1 Temperature Versus Humidity - Enclosed Environments Outside Containment

6-050-11

Question #2:

Describe in sufficient detail the margin for temperature and humidity that is represented by the environmental qualification test conditions. This description should quantify the proposed magnitude for each and clarify how and where each margin is provided. This description should address *margin* in relation to intended platform *service conditions*, as each term is defined within IEEE Std 323-2003, which is endorsed by Regulatory Guide 1.209.

Answer #2:

The ALS Platform follows the standard Westinghouse Equipment Qualification methodology for qualifying safety grade equipment as documented in the NRC approved version of WCAP-8587, revision 6-A. As described in Section 7.1.1 of WCAP-8587, margin for mild environment abnormal environmental extremes is addressed by demonstrating equipment performance through a double cycle of abnormal service condition extremes as shown in Figure 1 of Section 5.1 of the ALS EQ test plan.

The temperature, humidity, voltage, frequency, and duration conditions of the EQ test for the ALS Platform are compared to the service conditions for each individual application as they become available to quantify actual margin.

Question #3:

Describe how the proposed approach for EQ will provide adequate assurance of operability for other untested FPGA-programmed variants of the boards. In addition to functionally identical standard boards, this justification should be sufficient to address the application specific FPGA program of core logic boards, which have been proposed to be type tested as a representative application. Within this description clarify any role that application specific System Commercial Grade Dedication (CGD) is intended to contribute to assurance of operability.

Answer #3:

The Equipment Qualification (EQ) of the ALS platform is intended to qualify the ALS hardware. Any changes that are made after performing EQ testing will be evaluated to determine if the change impacts the qualification or the design. All changes are controlled by the processes defined in the "ALS Configuration Management Plan," 6002-00020. Potential changes to an ALS board can be categorized as either hardware or FPGA changes. Since hardware changes on the board will be handled in the same way that changes have been evaluated on past projects, this discussion will focus on changes to the FPGA.

Some signals are generated within the FPGA and do not leave the device. They are never routed to the input/output pins. For these signals, the key factors that could impact qualification results are timing and operating frequency. The design process will ensure that all timing constraints are satisfied. For ALS, the operating frequency is controlled in hardware by the crystal on the board, and would be evaluated using the methods to evaluate hardware changes. Therefore, since the ALS boards will have the same operating frequency and the FPGA changes will be evaluated to verify that they do not impact the safety functions, it can be concluded that changes to internal signals of the FPGA will not affect the qualification.

Signals that have effects outside of the FPGA can be examined in two categories. The first is a signal that drives other devices on the board. Changing the sampling rate of an analog to digital converter would be one such example. The second is a function that has an impact on the function of the board. An example of this type of change is a modification to the digital filter of an input signal. Any changes in these categories need to be evaluated to determine the impact to the qualification. The evaluation will be documented as part of the design change.

The Core Logic Board within the ALS platform is designed such that all hardware interfaces on the board remain the same, regardless of the specific application. The functions that will be added to the FPGA for an application will use the same input/output pins of the FPGA. Only the programming internal to the FPGA will need to be changed from application to application. For this reason, the signals will all be signals that are limited to the FPGA, and will not impact the platform qualification as long as the new functions are evaluated as discussed in the paragraphs above. The design process for the overall system will validate the functionality of the system, and will assess all aspects of extending the qualification of the platform for use in the specific application. These functions will be part of that overall evaluation that will be performed in the system design and test phases.

The discussion above addresses the operation of the boards that are part of the ALS Platform. As these boards are used in an application, the Critical Characteristics of the applications will be evaluated and an application specific Commercial Grade Dedication will verify all of the system's critical characteristics.

Question #4:

Describe how the failures allowed by the ALS EQ Plan's acceptance criteria [B] or [C] are captured and evaluated to ensure that the reported failure is not symptomatic of a functional or performance degradation for a future plant specific application. Describe how this evaluation will be used to demonstrate that the qualification testing is adequate for plant specific equipment configurations, behavior, and safety-functions of future license amendments that reference the topical report. This description should include a discussion of the characteristics captured for the power supply inputs to the ALS Platform; because, the power supply is outside of the topical report scope but its performance could materially affect the EMI/RFI test results, including some that apply acceptance criteria [B].

Answer #4:

The acceptance criteria listed as [B] or [C] should be criteria [A] for all EMI/RFI tests required by Regulatory Guide 1.180 revision 1, but the change has not yet been captured in the current revisions of the ALS Topical Report and the ALS EQ Plan. No failures of the ALS Platform during qualification testing are permitted. The ALS Platform must demonstrate the ability to operate before, during, and after each qualification test.

The ALS Platform is being tested with a qualified power supply that has the capability to protect against power related EMI/RFI disturbances. It is expected that the qualified power supply or an equivalent will be used in conjunction with the ALS Platform when it is installed in a specific application.

Question #5:

Describe what is meant by “a reasonable amount of time,” as used in the acceptance criteria [B] of section 4 of the ALS EQ Plan, to quantify this term and to clarify any relationship that allowable durations may have on operability assessments or plans to establish Technical Specification Allowed Outage Times or Completion Times (AOTs/CTs). This description should clarify the expected equipment response when these failures have been detected and indicated but have not yet cleared.

Answer #5:

The acceptance criteria listed as [B] or [C] should be criteria [A] for all EMI/RFI tests required by Regulatory Guide 1.180 revision 1, but the change has not yet been captured in the current revisions of the ALS Topical Report and the ALS EQ Plan. The ALS Platform must demonstrate the ability to operate before, during, and after each qualification test.

Question #6:

Describe all features of the test configuration that contribute to its behavior in response to detectable failures. This description should include, but not necessarily be limited to, its configured fail-safe states, the class of each detectable failure (fatal, vital or non-vital), the ability of the self-testing to detect and report performance beyond specified operating tolerances, and the logic within its core logic board in response to detected failures.

Answer #6:

The acceptance criteria listed as [B] or [C] should be criteria [A] for all EMI/RFI tests required by Regulatory Guide 1.180 revision 1, but the change has not yet been captured in the current revisions of the ALS Topical Report and the ALS EQ Plan. The ALS Platform must demonstrate the ability to operate before, during, and after each qualification test. Therefore any indication of failure, regardless of its class, indicates a failed test and the inability of the system to perform the safety function. The details of the test setup and equipment will be documented in the EQ Summary Report. As the ALS Platform is used in an application, all requirements in the application will be tested as part of the application project.

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** Electronically approved records are authenticated in the electronic document management system.*