ALS PLATFORM AUDIT SUMMARY REPORT

1. BACKGROUND AND REGULATORY AUDIT BASIS

By letter dated July 29, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102160471), CS Innovations, LLC, (CSI) submitted the platform topical report, 6002-00301, "Advanced Logic System (ALS) Topical Report." This letter and subsequent submittals support the ALS platform's review by the U.S. Nuclear Regulatory Commission's (NRC's) staff. The ALS platform design and development is shared between two facilities: Scottsdale, AZ, and Warrendale, PA. CSI is a Westinghouse company. Before the audit, Westinghouse made some supporting audit information available to the NRC Office of Nuclear Reactor Regulation, Division of Engineering, Instrumentation and Controls Branch (EICB) at the Westinghouse Regulatory Affairs office in Rockville, MD, to facilitate the NRC staff's preparation.

This regulatory audit supports the NRC staff's safety evaluation of the ALS platform's life-cycle processes and process outputs through a confirmation that CSI/Westinghouse has performed its processes in a manner that can satisfy regulatory requirements for safety system applications at nuclear power plants that choose to use the ALS platform. The audit provided access to ALS platform documentation consistent with digital instrumentation and control (I&C)-ISG-06, "Task Working Group #6: Licensing Process, Interim Staff Guidance," which identifies information that is not required to be submitted on the docket. This audit-only documentation has been previously identified and described within the "Advanced Logic System Topical Report" and supporting references. The audit also provided access to a variety of personnel who are responsible for performing various aspects of the ALS platform development. Following the audit, Westinghouse expressed its intent to continue to provide supporting audit information via the SharePoint site that Westinghouse has made accessible to the NRC staff. The NRC staff expects that the SharePoint site can be used to facilitate the closure of staff audit observations.

2. AUDIT SUMMARY

The NRC staff conducted the regulatory audit for the ALS platform development at the CSI facility in Arizona and the Westinghouse facility in Pennsylvania. Staff from NRR/DE/EICB (Bernard Dittman and Richard Stattel) and NRO/DE/ICE1 (Royce Beacom) performed the audit activities over 2 days at each facility, as follows:

- November 26 through 27, 2012, at CSI, 7400 E. Tierra Buena Lane, Suite 101, Scottsdale, AZ

- November 29 through 30, 2012, at Westinghouse, 5000 Ericsson Drive, Warrendale, PA

The ALS platform audit was performed based on a previously published audit plan, which had been made available to Westinghouse/CSI (ADAMS Accession No. ML12275A005).

Westinghouse Nuclear Automation and CSI personnel, who participated in substantive discussions during the audit, include the following:

- M. Mutyala (Vice President, Engineering & Products, Westinghouse)
- L. E. Erin (Director, Regulatory Oversight, Westinghouse)
- R.S. Roberts (Director, Scottsdale Operations, CSI)
- C. Roslund (Consulting Engineer, Westinghouse)
- M. Maher (Manager, (Independent Verification and Validation) IV&V Section I, Westinghouse)
- W. R. Odess-Gillett (Fellow Engineer, Licensing, Westinghouse)
- S. Smith (Licensing Project Manager, Westinghouse)
- K. Neumann (ALS Project Manager, CSI)
- D. Harmon (I&C Product Quality, Westinghouse)
- C. Bobbitt (Quality, CSI)
- W. Irmen (Operations Manager, CSI)
- B. Wheeler, (Senior Network Administrator, IT, CSI)
- G. Spagnolo (Principal Engineer, Design Core B Lead, CSI)
- R. Mancuso (Principal Engineer, IV&V, CSI)
- D. Andersen (Principal Engineer, IV&V, CSI)
- A. Chandrasekhara (Principal Engineer, IV&V, Westinghouse)

Following introductions, the NRC staff confirmed that Westinghouse/CSI understood and could support the objectives in the published audit plan during an entrance briefing. To support NRC personnel less familiar with the ALS platform's documentation, Westinghouse/CSI (M. Maher) provided an overview of the design and development documentation (e.g., requirements, design specifications, verification and validation (V&V), etc.) and any relationships among the documents. The NRC staff acknowledged that the identified and described document sets were consistent with previously docketed information, including the ALS Platform Requirement Traceability Matrices (RTMs). These RTMs reference a subset of the identified documents, and the NRC staff reviewed a representative sample of documents when pulling requirement threads from initial requirement specification through design specifications and to corresponding V&V activities. The NRC staff initially pulled requirement threads as a group before separating to further address individual audit plan objectives.

At the end of the first and second days, the NRC staff provided interim status briefings for each day's activities and observations. On the last day of the audit, November 30, 2012, the NRC staff conducted an exit briefing to summarize all observations and acknowledged that each objective in the audit plan had been addressed.

Sections 3 through 6 of this audit summary report summarize the audit plan objectives, along with the audit activities and results. Any staff observation that resulted from an audit activity is summarized within the results of its corresponding section. For staff observations, Westinghouse/CSI opened a corrective action process (CAP) item in accordance with its internal procedures.

In addition to the objectives documented in the audit plan, on November 29. 2012, Westinghouse personnel in Warrendale, PA, provided a briefing on responses to prior staff comments for equipment qualification activities. Section 7 summarizes this discussion.

Also on November 29, 2012, Westinghouse engaged the NRC staff in a general discussion of the degree that the NRC staff's safety evaluation of the ALS platform could generically address the platform's built-in diversity claims in terms of common-cause programming error considerations and in support of future licensee and application-specific diversity and defense-in-depth analyses.

Section 8 provides a tabular summary of all staff observations, along with an identification of any corresponding CAP item number that Westinghouse/CSI has created to address it.

Section 9 identifies the documents that were made available to the NRC staff for its use during the audit by configuration controlled number or name, revision, and date.

An additional purpose of the regulatory audit is to provide an opportunity for the NRC staff to identify and request information for submittal on the docket to provide an official agency record under oath and affirmation that supports a staff safety conclusion. Section 10 identifies a list of documents that the NRC staff requested to be placed on the docket and provides the rationale for each request. Section 11 similarly identifies a list of documents; however, the NRC staff requested that this information be placed on a staff accessible SharePoint for reference within this audit report and consistent with the guidance provided by Digital I&C-ISG-06.

3. FPGA PROGRAMMING V&V

This audit activity addressed the field programmable gate array (FPGA) programming development for ALS platform against criteria in Institute of Electrical and Electronics Engineers (IEEE) Standard (Std) 1012, "Systems and Software Verification and Validation [V&V]," including V&V activities that independently verify and validate the design outputs.

The NRC staff performed thread audits of a sample of requirements to assess the traceability of requirements through implementation and formal independent verification and validation, as described in the ALS V&V plan. The NRC staff also assessed the approaches used to independently validate that design specifications satisfied requirements and to ensure that these specifications and requirements were independently verified. The NRC staff assessed configuration control requirements and design specifications from top level platform requirements down to level board-specific FPGA design specifications. The NRC staff's sampling focused primarily on a single board, the ALS-321 voltage and current analog input board. Furthermore, the NRC staff selected specific requirements to audit based on significance to the NRC staff's safety evaluation. The NRC staff performed thread auditing of the platform requirements associated with the platform's paired-core diversity attribute. The NRC staff also performed a thread audit of the board-specific response time requirements of the ALS-321. During this activity, the NRC staff used requirements traceability matrices (Ref. 9.2, 9.49, 9.51) and the matrices' mappings among the configuration controlled specifications for requirements (Ref. 9.3 and 9.38), design (Ref. 9.39, 9.45, 9.48, and 9.50), and IV&V (Ref. 9.42, 9.43, 9.46, 9.47). The NRC staff made several observations during the performance of this audit activity.

The NRC staff observed that the response time test criteria in 6002-32102, ALS-321 Design Specification (Ref. 9.39, Design Specification ID D029), exceeded the specified maximum

response time of its parent requirement in 6002-32101, ALS-321 Requirements Specification (Ref. 9.38, Requirement ID R0601). The NRC staff confirmed that the actual test results were consistent with anticipated worst-case performance and did not exceed the parent requirement, although the applied test criteria was less conservative than the parent requirement and did not ensure that the parent requirement would be satisfied This observation is captured in Section 8 as Ref. 8.1.

The NRC staff observed the wording of a channel isolation requirement in 6002-32101, ALS-321 Requirements Specification (Ref. 9.38, Requirement ID R0312), did not correctly match the requirement's intent because the intent of the withstand requirement is to satisfy both conditions individually rather than one condition or the other. The NRC staff confirmed that the corresponding tests were consistent with intent of the requirement to satisfy both conditions individually by reviewing the associated manual test procedure (MT20). This observation is captured in Section 8 as Ref. 8.2.

The NRC staff observed the CSI20 format requirement was incorrectly stated in Table 7.8-1 of 6002-32106, ALS-321 FPGA Design Specification (Ref. 8.45, Design Specification ID D052). This observation is captured in Section 8 as Ref. 8.3.

As described in 6002-00003, ALS V&V Plan, the NRC staff observed that the IEEE Std. 1012-1998 mapping is not fulfilled entirely by ALS platform IV&V activities. The 6002-00003, ALS V&V plan, Table 2-1 states whether an IEEE Std. 1012-1998 V&V activity is applicable for the ALS V&V plan. However, some of the activities with "No" will be required for application-specific uses of the ALS platform. This observation is captured in Section 8 as Ref. 8.4.

The NRC staff observed that the Requirement Traceability Matrices (RTMs) (Ref. 9.15, 9.17, 9.25, 9.27, 9.35, 9.37, 9.49, 9.51, 9.59, 9.61, 9.69, 9.71, 9.79, and 9.81) do not explicitly and directly provide mapping to FPGA programming test cases and test results, as provided for within the guidance of IEEE Std 1012-1998. This observation is captured in Section 8 as Ref. 8.5. Nevertheless, the NRC staff was able to trace the verification of FPGA programming specifications to test cases and test results using available documentation that is under configuration control. This tracing activity relied upon the documents identified under the RTM's three "Test and IV&V" columns of "ABTS Test" (Ref. 9.11, 9.21, 9.31, 9.42, 9.55, 9.65, and 9.75), "Manual Test" (9.10, 9.20, 9.30, 9.40, 9.54, 9.64, and 9.74), and "ISE Simulation" (9.13, 9.23, 9.33, 9.46, 9.57, 9.67, and 9.77). Each of these documents (6002-xxx61, 6002-xxx42, and 6002-xxx16, respectively) are board-specific and provided the information to correlate the RTM test identifiers to the corresponding test case details for an ALS platform board. The NRC staff confirmed that corresponding test results for automatic board test cases and manual test cases were provided within the 6002-32194, ABTS-321 Test Summary Report (Ref. 9.43). The NRC staff also confirmed that corresponding test results for FPGA simulation covergroup test cases were provided within the 6002-32182, ALS-321 VV Summary Report (Ref. 9.47).

The NRC staff performed a thread audit for the requirements associated with paired-core diversity starting from the Platform Requirement PR0732 within 6002-00010, ALS platform

requirements specification (Ref. 9.3). While auditing this thread, the NRC staff observed that customized constraints must be detailed in each board-specific design specification to fulfill the requirement. However, the RTM entries for PR0732 did not identify any design specifications in the 6002-xxx03 Core A design specification. This lack of documentation appeared to the NRC staff as a gap in the traceability because the common module design specifications do not provide a complete list of core outputs to be compared. As such, the RTM could not be used to confirm the completeness of the feature and its corresponding verification. The NRC staff also noted that application-specific specifications for the ALS-102 board are expected to include specifications for a list of core outputs to be compared by the ALS-102 board. This observation is captured in Section 8 as Ref. 8.6.

As a supplement to the thread audits, the NRC staff witnessed an automatic board test case demonstration (presented by B. Mancuso) and a walkthrough of the manual test procedure that is used to verify the channel isolation requirement (presented by D. Andersen). It was during these demonstrations that the NRC staff confirmed that the acceptance test procedures for the platform's boards, which will be associated with issuance of each board's certificate of compliance, have not yet been developed and should be considered outside of the ALS platform scope. The NRC staff was informed that Westinghouse/CSI expects that these procedures will be based upon a selected subset of the ALS Board Test System (ABTS) automatic tests and manual tests.

During the audit, the NRC staff was presented current organizational charts governing the ALS platform development, discussed the roles and responsibilities with Westinghouse/CSI management, and assessed the organizational structure for independence characteristics of the V&V team in terms of cost, schedule, and management from project management and the design team. The NRC staff confirmed that the organizational structure provides independence of the V&V team in terms of cost, schedule, and management from project management and the design team.

4. CONFIGURATION MANAGEMENT

This audit activity addressed the configuration management system applied to the ALS platform products and documentation. This audit activity included a review of the configuration controls to govern the platform hardware and FPGA programming design, development, testing, and IV&V with CSI personnel responsible for performing configuration management activities (B. Irmen, B. Wheeler, K. Neumann).

Westinghouse/CSI presented a walkthrough of the formal document configuration control and change process wherein mock revisions were created for formal release and routing using Westinghouse/CSI's configuration management tool, Concurrent Version System (CVS). During this presentation the NRC staff confirmed that user login password requirements applied to the CVS's use and that automatic screen locking with password protection was administratively required for workstations with access to the controlled repository. The staff also confirmed that Westinghouse/CSI's practices limited user rights and privileges based on the user's ALS platform project role to ensure that the segregated design information remained protected by a firewall between independent teams. These privilege and data-access restrictions directly support the ALS platform's claim of design diversity. However, it appeared

to the NRC staff that these practices were not formalized through documented procedures or work instructions because none could be provided. Formalizing this practice would be necessary to ensure ALS platform design diversity claims are directly supported over time. Later discussions with Westinghouse/CSI management extended this observation beyond the granting of CVS data access to the control of assignment of personnel within the IV&V teams and between the design teams. This observation is captured in Section 8 as Ref. 8.7.

The NRC staff had noted mismatches between dates provided on the Configuration Status Accounting Reports when compared to the dates contained on the document's title page, so the NRC staff requested an explanation of the process used to create the various ALS platform Configuration Status Accounting Reports (Ref. 9.1 and 9.41), including the document dates contained in the reports. From this process walkthrough, it became apparent that the entry date in the release record is what is propagated to the Configuration Status Accounting Reports. This date, however, does not always match the actual date of the document. This observation is captured in Section 8 as Ref. 8.10.

During the demonstration of the mechanisms by which the CVS tool prevents multiple individuals from inadvertently checking out a particular version of a controlled configuration item for parallel modification, the NRC staff observed that the configuration tool did not respond as expected by the configuration manager performing the demonstration. Westinghouse/CSI explained and demonstrated to the staff that, for some situations and documents, the tool did not allow parallel check-outs. For other situations and documents, however, the tool did allow a parallel check-out only to later prevent modifications from being checked back in by anyone other than the first individual to check out the document. The tool was effective in preventing the second modifier from completing a parallel modification, but it could result in rework. The NRC staff expressed a concern that any subsequent increased time pressures stemming from the mismatch between expected and actual tool performance could adversely affect the subsequent rework. This observation is captured in Section 8 as Ref. 8.11.

Westinghouse/CSI staff described the use of the OnTime™ ticket process to the NRC staff. The OnTime™ system was used to report anomalies in configuration controlled ALS platform documentation and products, to initiate corrective actions, and to track the closure of anomalies during the ALS platform's development. The NRC staff assessed a variety of OnTime™ tickets. An OnTime™ ticket number (#) is the anomaly report identifier. As described, the reporter of a specific anomaly is not necessarily formally included in the acceptability of its closure; rather, there is the expectation that if a considered anomaly was not adequately resolved, then one should create a new OnTime™ ticket to address any unresolved aspects of a prior anomaly.

The NRC staff walked through two examples of the OnTime™ anomaly workflow to include the tracking of the anomaly report from creation to resolution. The first example was initiated by the IV&V team against the ALS-311 FPGA and the second was initiated by the Design Team against the ALS-421 circuit board as part of in-process design checks. As documented in the OnTime™ system for the first anomaly, the IV&V team used FPGA RTL simulations to identify an anomaly in the ALS-311 FPGA. The simulation scoreboard contained an expected result for a particular waveform that was inconsistent with the results of the actual FPGA programming (RTL) simulation. The Design Team modified the RTL to correct it and resolve the anomaly.

As documented in the OnTime™ system for the second anomaly, the design team identified actual values that were out of tolerance from expected values for the Build Version 2.10 of an ALS-421 FPGA. The Design Team then incorporated corrections into Build Version 2.12.

The NRC staff spent time discussing the implications of OnTime™ ticket #4277 on the NRC staff's prior understanding of the ALS platform's built-in design diversity basis and possibly on the safety evaluation for the platform. Ticket #4277 is identified in the docketed 6002-00500, ALS Platform VV Summary Report, Revision 1, dated October 2012. The ALS Platform VV Summary Report describes ticket #4277 as identifying that the PR0732.1 paired core synthesis diversity requirement was not entirely satisfied as expected. Ticket #4277 spawned actions to correct the cause of the misaligned expectation; however, it became apparent that these actions did not rebuild the FPGAs images [ ] for all finite state machines at all levels of the FPGA hierarchy and on all ALS platform boards. Based on the discussions of potential implications of OnTime™ ticket #4277, the staff created an observation that is captured in Section 8 as Ref. 8.8. Further actions depend on Westinghouse/CSI's approach to address this observation.

The NRC staff spent time discussing implications that OnTime™ ticket #3755 may have on the ALS platform human diversity basis and the safety evaluation for the platform. Written exchanges within the OnTime system for Ticket #3755 indicate that the [ ]. Ticket #3755 was written against the 6002-32106, ALS-321 FPGA design specification (Ref. 9.45), which applies to [FPGA design implementations. The design lead [ ] also happened to be responsible for the affected document, which is a parent specification [ ]. Nevertheless, it was not clear to the NRC staff that any administrative controls are in place to prevent a similar breakdown [ ]. Based on the discussions of potential implications of OnTime™ ticket #3755, the staff created an observation that is captured in Section 8 as Ref. 8.9.

5. FPGA PROGRAMMING QUALITY ASSURANCE

This audit activity addressed the quality assurance program applicable to the ALS platform products and documentation.

Westinghouse/CSI identified to the NRC staff that the Quality Assurance program defined by the 9000-00000 Quality Assurance Manual was in the process of being transitioned to Westinghouse's Quality Management System (QMS). Individual quality assurance procedures are being evaluated to identify best practices as part of this transition. Eventually, Westinghouse/CSI will phase out the 9000-00000 Quality Assurance Manual in favor of the Westinghouse QMS. Separate from this audit and by letter dated February 24, 2011, NRC staff concluded that that Revision 6 to the Westinghouse QMS continues to meet the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of

Production and Utilization Facilities," and is therefore acceptable (ADAMS Accession No. ML110310088). Westinghouse (W.R. Odess-Gillette) made available a copy of this letter in support of the transition discussion. This observation is captured in Section 8 as Ref. 8.12.

The NRC staff discussed quality assurance (QA) activities with QA personnel (D. Harmon and C. Bobbitt). During these discussions, the NRC staff confirmed that the quality assurance processes and procedures are subject to the same configuration management, corrective action, and change management activities that apply to ALS platform configuration items. The NRC staff asked how the QA program determines the effectiveness of the technical processes, procedures, and work instructions in ensuring the quality of FPGA programming. The Westinghouse/CSI QA personnel explained that audits are used to identify quality improvement areas, and the process owners of each specific technical area are relied upon to propose the initial processes and procedures and any changes to address audit findings. After postulating an ineffective process, the Westinghouse/CSI QA personnel explained that the standard corrective action processes would be followed as had been previously demonstrated to the staff for anomaly correction and configuration management. Westinghouse/CSI further explained that should a technical difference of opinion exist regarding the effectiveness of a particular process, procedure, or work instruction, then third-party experts would typically be consulted to resolve the difference of opinion to ensure that the process, procedure, or work instruction modification would provide the improved level of quality being sought.

Westinghouse/CSI explained that the OnTime™ ticket data was monitored to trend unresolved defect reports, but this data was neither analyzed nor subjected to any specific criteria as a metric to assess FPGA programming quality. Westinghouse/CSI provided a graph entitled "ALS Defect Summary Overall." This graph showed the number of defects that were unresolved over time. The graph does not identify the number of defects identified or corrected per month and instead shows only the total defects that remained unresolved as of a given month. A note on the chart also identified 22 of the OnTime™ tickets as "on hold." "On hold" tickets are not intended to be corrected as part of the ALS platform effort. Excluding the "on hold" tickets, the graph showed about 50 unresolved OnTime™ tickets. The NRC staff reviewed several of the on-hold tickets to assess the basis for leaving them unresolved. During this review, the NRC staff observed that not all of the OnTime™ tickets fall within the scope of the ALS platform, as defined within the ALS topical report. This observation is captured in Section 8 as Ref. 8.13.

6. FPGA PROGRAMMING SAFETY

This audit activity addressed the Westinghouse/CSI approach to FPGA programming safety plans as applicable to the ALS platform scope.

The NRC staff confirmed the ALS platform safety planning scope is limited, and Westinghouse/CSI intends to fully address software safety plans on an application-specific basis. Westinghouse/CSI's approach to supporting application-specific software safety plan development for applications of the ALS platform will be based on failure mode effects analyses, which have been submitted on the docket for each board, along with ALS platform design features that have been specified to detect equipment failures and mitigate failure effects. These design features include continuous self tests, diagnostics, redundancy, and fail-safe configurability of the platform.

7. EQUIPMENT QUALIFICATION DISCUSSION

Westinghouse/CSI described its path forward to address the type-testing performed for the ALS platform and resolve prior to NRC staff comments. This path forward is intended to address the adequacy of the unit under test during equipment qualification, to ensure that the type tested equipment is sufficiently representative of the ALS platform's intended use, and to demonstrate that the equipment qualification can be logically extended as bounding for a plant's application-specific use. The NRC staff understands that information reflecting Westinghouse/CSI planned actions will be available to the NRC staff by the end of January 2013, as identified in Sections 10 and 11. During audit discussions, the NRC staff observed that a commitment to IEEE 323-2003, as endorsed by Regulatory Guide (RG) 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Computer Systems in Nuclear Power Plants," is not clearly and consistently stated in the ALS equipment qualification (EQ) plan and ALS topical report. This observation is captured in Section 8 as Ref. 8.14.

8. SUMMARY OF STAFF OBSERVATIONS

The following table provides the list of 14 staff audit observations, and it groups similar observations under a descriptive heading. The table identifies each observation by a summary description for use as a forward reference from within earlier sections. The table also includes any CAP identifier that Westinghouse/CSI created to address the observation along with NRC staff expectations related to each item's resolution, while recognizing that Westinghouse/CSI has yet to fully assess the observations, formally propose corrective actions, or process corrective actions to completion.

Ref.	Summary Description	CAP Identifier	Expectations for Resolution
Observations Relating to Traceability Analysis			
8.1	Test criteria did not verify the specified requirement.	12-332-M025	Westinghouse/CSI: Correct affected documentation. Perform causal analysis and extent of condition analysis. Enhance IV&V verification analysis activities to prevent similar recurrences.
8.2	Mismatch between specification wording and intent.	12-332-M032	Westinghouse/CSI: Correct affected documentation. Perform causal analysis and extent of condition analysis. Enhance IV&V requirement analysis activities to prevent similar recurrences.

Ref.	Summary Description	CAP Identifier	Expectations for Resolution
8.3	Design specification error.	12-331-M068	Westinghouse/CSI: Correct affected documentation. Perform causal analysis and extent of condition analysis. Enhance IV&V requirement analysis activities to prevent similar recurrences.
8.4	The ALS V&V plan commits to a variety of IEEE Std 1012-1998 tasks, while other tasks are deferred to the application. The scope of the ALS V&V plan includes guidelines for subsequent ALS-based application projects; however, no guidance is included for the V&V tasks in the Operation and Maintenance phases.	12-334-M026	NRC staff: Document in the ALS topical report safety evaluation and create an application-specific action item to identify the IEEE 1012 tasks that are deferred to licensees that reference the platform topical report, because the tasks are identified as inapplicable for the platform. Application-specific actions should ensure that these activities are included in the project-specific V&V plan. The application-specific evaluation should include a review of any exceptions made to performance of any tasks and verify that the intended activities are being achieved via alternate means wherever necessary and applicable.
8.5	The RTMs do not explicitly and directly provide mapping to test cases and test results.	*None identified or considered necessary by the NRC staff.*	NRC staff: Document in the ALS topical report safety evaluation the explanation of how specific test cases and results are reached through available documentation and references that are contained in the RTMs.
8.6	Definition of and requirement tracing for the set of signals subjected to the requirement is unclear and ambiguous.	12-332-M030	Westinghouse/CSI: Correct affected documentation. Perform causal analysis and extent of condition analysis. Enhance IV&V requirement analysis activities to prevent similar recurrences. NRC staff: Document in the ALS topical report safety evaluation and create an application-specific action item to define and verify the application-specific signal sets.

Ref.	Summary Description	CAP Identifier	Expectations for Resolution
Observations Relating to a Potential Degradation of Diversity Claims			
8.7	Lack of procedures or work instructions to ensure institutionalized human diversity for ALS task assignments and design documentation access.	12-332-M022	Westinghouse/CSI: Creation of appropriate procedures/work instructions governing work assignments and design information access. Reference these procedures/ work instructions from within a documentation that can be found through information that has been placed on the docket as part of the ALS topical report. Make these procedures/work instructions availability for audit. NRC staff: Audit these procedures/work instructions when available. Document in the ALS topical report safety evaluation when discussing human diversity.

Ref.	Summary Description	CAP Identifier	Expectations for Resolution
8.8	The FSMs on all boards do not include encoded digital logic.	12-335-M028	Westinghouse/CSI: Perform an extent of condition analysis to determine whether this observation extends to the Wolf Creek MSFIS and is contrary to the basis of the NRC staff's prior safety determination as documented in the Wolf Creek MSFIS safety evaluation report. Westinghouse/CSI: Decide and document its approach to resolve the observation. As an example, two options are provided: 1. Update the ALS platform docketed information relating to all diversity statements to clearly identify this approach, justify the limitation and provide rationale for the FSMs that shall be encoded using both logic schemes, and unambiguously identify ALS platform functionality is not provided in encoded digital logic. 2. Rebuild affected ALS platform FPGA images and perform regression testing and analysis, as applicable. Submit revised information on the docket that reflects the revised FPGA programming for reference within the NRC staff's safety evaluation. NRC staff: By way of the preceding examples, if the first option is taken, then the NRC staff will document its revised understanding in ALS topical report safety evaluation and likely create additional application-specific action items. If the second option is taken, then—although the NRC staff's prior understanding is unaffected—the safety evaluation will need to be revised to reflect the new FPGA versions.

Ref.	Summary Description	CAP Identifier	Expectations for Resolution
8.9	Discussions can occur within OnTime™ ticket resolution records keeps the design teams independent of IV&V direction.	*None identified but may be included within 12-332-M022.*	Westinghouse/CSI: Creation of appropriate work instructions to control design approaches within the information systems used to identify and correct anomalies. Reference these work instructions from within documentation that can be found through information that has been placed on the docket as part of the ALS topical report. Make these work instructions availability for audit. NRC staff: Audit these procedures and work instructions when available. Document in the ALS topical report safety evaluation when discussing human diversity.
Observations Relating to Configuration Management Activities			
8.10	Release record dates mismatch actual documentation and are propagated into configuration status reports.	12-332-M031	Westinghouse/CSI: Correct affected documentation. Perform causal analysis and extent of condition analysis. Enhance configuration control and record release activities to prevent similar recurrences.
8.11	Operation of configuration tool did not match user's expectations and allowed records to be check-edited even though another had obtained the sole edit privilege.	12-332-M029	Westinghouse/CSI: Correct the anomalous tool behavior to align user expectations with the configuration management tool's actual performance. Alternatively, enhance procedures and work instructions and provide training to correctly align user expectations with the configuration management tool's actual performance.
Observations Relating to Quality Assurance and Programming Quality Metrics			
8.12	The CSI Quality Assurance program is transitioning to fall under the Westinghouse QMS program.	*None identified or considered necessary by the NRC staff.*	NRC staff: Document this in the ALS topical report safety evaluation when discussing Appendix B quality assurance. Highlight the planned evolution for consideration by licensees that may reference the ALS platform's safety evaluation, and for consideration by the NRC staff for any future licensing action that references the ALS platform's safety evaluation.

Ref.	Summary Description	CAP Identifier	Expectations for Resolution
8.13	The ALS defect summary report includes some items that are beyond the ALS topical report scope.	*None identified or considered necessary by the NRC staff*	NRC staff: Document this in the ALS topical report safety evaluation when discussing metrics as referenced within the ALS Management Plan.
Observation Relating to Equipment Qualification Documentation			
8.14	An equipment qualification commitment to IEEE 323-2003 as endorsed by RG 1.209 is not clearly and consistently stated in the ALS EQ Plan and ALS topical report.	12-334-M018	Westinghouse/CSI: Correct affected documentation and resubmit on the docket. NRC staff: Document this in the ALS topical report safety evaluation when discussing equipment qualification.

9. INFORMATION AVAILABLE DURING THE AUDIT

The following table identifies the most recent revision of documents that were made available to the NRC staff in preparation for and for use during the audit without excluding items that may have been submitted on the docket at the identified revision. The first column of the table is a reference for use as a forward reference from within earlier sections. The table identifies each document by configuration controlled document identifier, title, revision and date. The titles, revisions, and dates reflect the document's title page rather than configuration status reports or release records. The table groups documents under headings that relate the document's place within the ALS platform documentation hierarchy.

Ref.	Identifier	Rev	Date
Platform			
9.1	6002-00007, ALS Platform Configuration Status Accounting Report	4	11/01/2012
9.2	6002-00009, ALS Platform Requirements Traceability Matrix	1	11/06/2012
9.3	6002-00010, ALS Platform Requirements Specification	15	09/25/2012
9.4	6002-00011, ALS Platform Specification	11	09/24/2012
9.5	6002-00070, ALS EQ Rack System Specification	2	08/24/2012
Platform FPGA Core A			
9.6	6002-00016, FPGA Core A Common Module Design Specification	4	09/20/2012
Platform FPGA Core B			
9.7	6002-00017, ALS FPGA Core B Common Module Design Specification	1	08/23/2012
ALS-102 Core Logic Board			
ALS-102 Board			
9.8	6002-10201, ALS-102 Requirements Specification	2	08/27/2012

Ref.	Identifier	Rev	Date
9.9	6002-10202, ALS-102 Design Specification	2	10/08/2012
9.10	6002-10242, ALS-102 Release Test Design Specification	0	08/30/2012
9.11	6002-10261, ABTS-102 Test Design Specification	0	08/08/2012
ALS-102 FPGA			
9.12	6002-10206, ALS-102 FPGA Design Specification	1	08/23/2012
9.13	6002-10216, ALS-102 VV Simulation Environment Specification	0	08/28/2012
ALS-102 FPGA Core A			
9.14	6002-10203, ALS-102 Core A FPGA Design Specification	1	08/24/2012
9.15	6002-10210, ALS-102 Core A Requirements Traceability Matrix	1	10/11/2012
ALS-102 FPGA Core B			
9.16	6002-10204, ALS-102 Core B FPGA Design Specification	1	08/23/2012
9.17	6002-10211, ALS-102 Core B Requirements Traceability Matrix	1	10/11/2012
ALS-302 Contact Input Board			
ALS-302 Board			
9.18	6002-30201, ALS-302 Requirements Specification	3	07/04/2012
9.19	6002-30202, ALS-302 Design Specification	3	08/28/2012
9.20	6002-30242, ALS-302 Release Test Design Specification	2	08/29/2012
9.21	6002-30261, ABTS-302 Test Design Specification	0	08/08/2012
ALS-302 FPGA			
9.22	6002-30206, ALS-302 FPGA Design Specification	3	08/09/2012
9.23	6002-30216, ALS-302 VV Simulation Environment Specification	3	08/2012
ALS-302 FPGA Core A			
9.24	6002-30203, ALS-302 Core A FPGA Design Specification	2	08/24/2012
9.25	6002-30210, ALS-302 Core A Requirements Traceability Matrix	4	10/09/2012
ALS-302 FPGA Core B			
9.26	6002-30204, ALS-302 Core B FPGA Design Specification	1	08/2012
9.27	6002-30211, ALS-302 Core B Requirements Traceability Matrix	2	10/10/2012
ALS-311 RTD and Thermocouple Input Board			
ALS-311 Board			
9.28	6002-31101, ALS-311 Requirements Specification	2	07/06/2012
9.29	6002-31102, ALS-311 Design Specification	3	10/03/2012
9.30	6002-31142, ALS-311 Release Test Design Specification	0	09/05/2012
9.31	6002-31161, ABTS-311 Test Design Specification	0	08/01/2012

Ref.	Identifier	Rev	Date
ALS-311 FPGA			
9.32	6002-31106, ALS-311 FPGA Design Specification	2	08/31/2012
9.33	6002-31116, ALS-311 VV Simulation Environment Specification	2	09/2012
ALS-311 FPGA Core A			
9.34	6002-31103, FPGA Core A - ALS-311 Design Specification	1	08/25/2012
9.35	6002-31110, ALS-311 Core A Requirements Traceability Matrix	1	10/12/2012
ALS-311 FPGA Core B			
9.36	6002-31104, ALS-311 Core B FPGA Design Specification	1	08/24/2012
9.37	6002-31111, ALS-311 Core B Requirements Traceability Matrix	1	10/15/2012
ALS-321 Voltage/Current Analog Input Board			
ALS-321 Board			
9.38	6002-32101, ALS-321 Requirements Specification	2	07/02/2012
9.39	6002-32102, ALS-321 Design Specification	4	09/21/2012
9.40	6002-32142, ALS-321 Release Test Design Specification	2	08/31/2012
9.41	6002-32150, ALS-321 Configuration Status Accounting Report	3	10/12/2012
9.42	6002-32161, ABTS-321 Test Design Specification	1	09/01/2012
9.43	6002-32194, ABTS-321 Test Summary Report	1	10/03/2012
9.44	8602-00010, Manufacturing Traveler 5002_321_10	1	09/13/2012
ALS-321 FPGA			
9.45	6002-32106, ALS-321 FPGA Design Specification	3	09/17/2012
9.46	6002-32116, ALS-321 VV Simulation Environment Specification	3	10/2012
9.47	6002-32182, ALS-321 VV Summary Report	2	10/2012
ALS-321 FPGA Core A			
9.48	6002-32103, ALS-321 Core A FPGA Design Specification	3	08/24/2012
9.49	6002-32110, ALS-321 Core A Requirements Traceability Matrix	5	10/12/2012
ALS-321 FPGA Core B			
9.50	6002-32104, ALS-321 Core B FPGA Design Specification	1	08/24/2012
9.51	6002-32111, ALS-321 Core B Requirements Traceability Matrix	3	10/12/2012
ALS-402 Contact Output Board			
ALS-402 Board			
9.52	6002-40201, ALS-402 Requirements Specification	1	07/05/2012
9.53	6002-40202, ALS-402 Design Specification	1	10/12/2012
9.54	6002-40242, ALS-402 Release Test Design Specification	0	08/02/2012

Ref.	Identifier	Rev	Date
9.55	6002-40261, ABTS-402 Test Design Specification	0	07/25/2012
ALS-402 FPGA			
9.56	6002-40206, ALS-402 FPGA Design Specification	1	08/23/2012
9.57	6002-40216, ALS-402 VV Simulation Environment Specification	0	08/2012
ALS-402 FPGA Core A			
9.58	6002-40203, ALS-402 Core A FPGA Design Specification	1	08/23/2012
9.59	6002-40210, ALS-402 Core A Requirements Traceability Matrix	1	10/16/2012
ALS-402 FPGA Core B			
9.60	6002-40204, ALS-402 Core B FPGA Design Specification	1	08/23/2012
9.61	6002-40211, ALS-402 Core B Requirements Traceability Matrix	1	10/16/2012
ALS-421 Voltage/Current Analog Output Board			
9.62	6002-42101, ALS-421 Requirements Specification	5	07/10/2012
9.63	6002-42102, ALS-421 Design Specification	2	10/12/2012
9.64	6002-42142, ALS-421 Release Test Design Specification	1	09/06/2012
9.65	6002-42161, ABTS-421 Test Design Specification	1	10/19/2012
ALS-421 FPGA			
9.66	6002-42106, ALS-421 FPGA Design Specification	5	10/09/2012
9.67	6002-42116, ALS-421 VV Simulation Environment Specification	3	10/2012
ALS-421 FPGA Core A			
9.68	6002-42103, ALS-421 Core A FPGA Design Specification	4	08/27/2012
9.69	6002-42110, ALS-421 Core A Requirements Traceability Matrix	2	10/25/2012
ALS-421 FPGA Core B			
9.70	6002-42104, ALS-421 Core B FPGA Design Specification	1	08/24/2012
9.71	6002-42111, ALS-421 Core B Requirements Traceability Matrix	2	10/25/2012
ALS-601 Communications Board			
9.72	6002-60101, ALS-601 Requirements Specification	3	09/21/2012
9.73	6002-60102, ALS-601 Design Specification	1	08/28/2012
9.74	6002-60142, ALS-601 Release Test Design Specification	0	09/04/2012
9.75	6002-60161, ABTS-601 Test Design Specification	0	07/24/2012
ALS-601 FPGA			
9.76	6002-60106, ALS-601 FPGA Design Specification	1	08/24/2012
9.77	6002-60116, ALS-601 VV Simulation Environment Specification	0	08/2012

Ref.	Identifier	Rev	Date
ALS-601 FPGA Core A			
9.78	6002-60103, ALS-601 Core A FPGA Design Specification	1	08/24/2012
9.79	6002-60110, ALS-601 Core A Requirements Traceability Matrix	1	10/17/2012
ALS-601 FPGA Core B			
9.80	6002-60104, ALS-601 Core B FPGA Design Specification	1	08/24/2012
9.81	6002-60111, ALS-601 Core B Requirements Traceability Matrix	1	10/17/2012

10. INFORMATION FOR THE DOCKET

The following list identifies information that NRC staff requested to be placed the docket during the audit. This list does not attempt to identify revised documents that either Westinghouse/CSI previously committed to submit or resubmit on the docket or that Westinghouse/CSI will revise to address audit observations and should be resubmitted on the docket.

10.1 6002-xxx01 – ALS-xxx requirements specification for each board, because the RTMs do not include the complete requirement text and the board level requirement specification is the first location that some requirements appear to define the ALS product.

- 10.1.1 6002-10201, ALS-102 Requirements Specification
- 10.1.2 6002-30201, ALS-301 Requirements Specification
- 10.1.3 6002-31101, ALS-311 Requirements Specification
- 10.1.4 6002-32101, ALS-321 Requirements Specification
- 10.1.5 6002-40201, ALS-401 Requirements Specification
- 10.1.6 6002-42101, ALS-421 Requirements Specification
- 10.1.7 6002-60101, ALS-601 Requirements Specification

10.2 Any revision to 6002-00200, ALS platform EQ summary report, to address prior staff comments, reflect the supplemental EQ testing and support the analysis to be provided in the 6002-00240 and 6002-00241 documents.

10.3 6002-00240, ALS platform qualification evaluation, because this document is intended to provide technical basis that justifies the as-performed and supplemented equipment qualification type testing for configurations of the ALS platform that were not represented in the type-tested device under test.

10.4 6002-00241, ALS FPGA qualification evaluation, because this document is intended to provide technical basis that justifies the adequacy of the as-performed and supplemented equipment qualification type testing when FPGA changes occur from the as-tested baseline.

10.5 Any revision to 6002-00008, ALS application guidance, to address any impacts of the supplemental testing, platform qualification evaluation, or FPGA qualification evaluation that create limitations or conditions on the use of the ALS platform by licensees.

10.6 6002-00009, ALS platform Requirements Traceability Matrix, because this RTM is required in addition to each board and design team specific RTM to demonstrate full requirements traceability through IV&V activities.

11. INFORMATION FOR SHAREPOINT

The following list identifies information that NRC staff requested to be placed in SharePoint during the audit. This list does not attempt to identify documents that either Westinghouse/CSI previously agreed to make available on SharePoint or that Westinghouse/CSI will revise to address audit observations and should be made available on SharePoint at the newer revision.

11.1 NA 4.51, Field Programmable Gate Array (FPGA) Development Procedure (revision to 9000-00313) that formally defines and control the activities associated with the analysis provided in the 6002-00241, ALS FPGA Qualification Evaluation.

11.2 6002-xxx16, ALS-xxx VV Simulation Environment Specification, for each board, because these documents identify the details of the simulation-based testing for each boards FPGA programming (Note: some but not all of these documents had been made available via SharePoint prior to the audit).

- 11.2.1 6002-10216, ALS-102 VV Simulation Environment Specification
- 11.2.2 6002-30216, ALS-301 VV Simulation Environment Specification
- 11.2.3 6002-31116, ALS-311 VV Simulation Environment Specification
- 11.2.4 6002-32116, ALS-321 VV Simulation Environment Specification
- 11.2.5 6002-40216, ALS-401 VV Simulation Environment Specification
- 11.2.6 6002-42116, ALS-421 VV Simulation Environment Specification
- 11.2.7 6002-60116, ALS-601 VV Simulation Environment Specification

11.3 Audit Reports to substantiate ALS quality assurance plan activities.

- 11.3.1 Report for WEC 11.56 Internal Westinghouse Audit, May 14-23, 2012
- 11.3.2 Report for PG&E Modified NUPIC Audit September 24-26, 2012 (Note: The PG&E audit report may be placed on Diablo Canyon SharePoint as an alternative to the Westinghouse's ALS platform SharePoint).

11.4 List of CAP items applicable to the ALS platform that have a summary status that indicates the item is or may have safety significance that has not yet been resolved.