

REPORT OF REGULATORY AUDIT ON AUGUST 2 – 3, 2016, IN ROCKVILLE, MD  
OFFICE OF NEW REACTORS  
INSTRUMENTATION, CONTROLS AND ELECTRONICS ENGINEERING BRANCH  
SOUTHERN NUCLEAR OPERATING COMPANY – VOGTLE UNITS 3 AND 4  
SOUTH CAROLINA ELECTRIC & GAS COMPANY – V.C. SUMMER UNITS 2 AND 3  
UPDATE OF COMMON QUALIFIED PLATFORM SOFTWARE PROGRAM MANUAL AND  
TOPICAL REPORT (LAR-15-017 & LAR 13-35)  
DOCKET NOS 52-025, 52-026, 52-027, 52-028

I. BACKGROUND

By letter dated February 15, 2016, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16046A009), Southern Nuclear Operating Company (SNC), the licensee for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, requested the United States Nuclear Regulatory Commission (NRC) approval of an amendment of the combined licenses (COL) for VEGP Units 3 and 4, nuclear power facility (NPF) COL Numbers NPF-91 and NPF-92, respectively. In addition, by letter dated March 4, 2016, (ADAMS Accession No. ML16067A145), South Carolina Electric & Gas Company (SCE&G), the licensee for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, requested the NRC's approval of a technically identical amendment request for NPF COL Numbers NPF-93 and NPF-94, respectively. The proposed license amendment requests (LAR) 15-017 and LAR 13-35 would revise the Updated Final Safety Analysis Report (UFSAR) text and tables, and information incorporated by reference into the UFSAR related to updates to WCAP-16096, "Software Program Manual for Common Q™ Systems," and WCAP-16097, "Common Qualified Platform Topical Report." The current licensing basis references WCAP-16096, Revision 01A and WCAP-16097, Revision 0, which have been superseded by later NRC-approved versions. The newer revisions of WCAP-16096 and WCAP-16097 are being adopted for the Advanced Passive 1000 (AP1000) Protection and Safety Monitoring System (PMS) by adding them to the AP1000 licensing basis.

LAR-15-017 was accepted for NRC review by letter dated March 22, 2016 (ADAMS Accession No. ML16076A362). LAR 13-35 was accepted for NRC review by letter dated April 25, 2016 (ADAMS Accession No. ML16092A319).

II. REGULATORY AUDIT BASIS

The purpose of this regulatory audit was to determine if the proposed design process changes and licensing documentation revisions continue to comply with the applicable regulatory criteria. The NRC staff determined that an audit of the SNC/SCE&G's supporting documentation was necessary to complete the staff's safety evaluation of the proposed LARs to establish the Common Qualified Platform (Common Q) SPM and Topical Report (TR) as the licensing basis for the development of the Common Q portion of the PMS in lieu of the applicable digital instrumentation & control (I&C) regulatory guides.

Enclosure

### III. AUDIT ACTIVITIES

The NRC staff performed the audit to review design process and licensing documents that were listed in LAR-15-017 and LAR 13-035 but were not submitted as part of the LARs. Documents reviewed during this audit activity are listed in Section VII of this report (see References 8 to 35).

The NRC staff conducted the audit at the Westinghouse (WEC) office located at 11333 Woodglen Drive, Suite 202, Rockville, MD, 20852. The staff conducted the audit in accordance with the guidelines in the Office of New Reactors (NRO) Office Instruction NRO-REG-108, "Regulatory Audits," (Reference 4).

### IV. AUDIT SUMMARY

The regulatory audit began with an entrance meeting held at 8:30 a.m. on Tuesday, August 2, 2016. At the entrance meeting, the NRC staff discussed the schedule of activities for the audit and the agenda. The NRC staff examined the licensing and design process documents that were listed in LAR-15-017 and LAR 13-35 but were not submitted as part of the LARs (see Section III of this report).

Throughout the audit period staff held question-and-answer sessions with SNC/SCE&G to address NRC staff's questions based on its review of these documents. In addition, the NRC staff communicated with SNC/SCE&G where additional information was needed to be incorporated in the LARs. The exit meeting was held at 4:00 p.m. on Wednesday, August 3, 2016. At the exit meeting, the NRC staff further communicated the results of their document reviews and discussed the status of request for additional information (RAI) responses with SNC/SCE&G.

Below is a summary of the audit activities, findings, and follow-up actions:

1. Software requirements specification for the PMS (WCAP-16097 Plant Specific Action Item (PSAI) 6.15): The staff reviewed the software requirements specification (SRS) for the PMS (Reference 33). Section 6 of the software requirements specification for the PMS defines the requirements for reporting the results of the inherent, automatic self-testing features of the Common Q platform during operation. The staff confirmed that the SRS included a requirement for the automatic self-testing/diagnostic features. The staff assessed the implementation of this requirement and found it acceptable.
2. AP1000 PMS Equipment Qualification Summary Report: The staff reviewed the AP1000 PMS Equipment Qualification (EQ) Summary Report (Reference 34). Below are three observations:
  - a. Dummy Modules (WCAP-16097 PSAI 6.4): The staff confirmed the Common Q test specimen was configured for seismic testing using dummy modules to fill all the used rack slots (References 29-32).

- b. Fiber Optic Cables (WCAP-16097 PSAI 6.20): The staff found that the EQ Summary Report did not provide a discussion of why the fiber optic cables were not considered or discussed in the EQ tests. While susceptibility to Electromagnetic interference/ Radio-frequency interference (EMI/RFI) is not a concern, other type tests during EQ testing should be considered and discussed in the EQ Summary Report. The Licensees agreed with the NRC staff's request and will include this discussion in their response to the staff's RAI and the EQ Summary Report.
- c. High Speed Links (WCAP-16097 PSAI 6.21): The staff found that the EQ Summary Report did not provide a discussion on how the High Speed Links (HSLs) were tested. The Licensees need to discuss the physical layout of the equipment and the types of EQ tests that were performed on the HSLs, and how the interactions between the fiber optic components and their translation devices to copper and other mediums were tested. The Licensees agreed with the NRC staff's request and will include this discussion in the proposed LARs and the EQ Summary Report.
- 3. Common Q Record of Changes (WCAP-16097 PSAI 6.23): The staff reviewed the list of changes described in Appendix 5, "Common Qualified Platform Record of Changes," of WCAP-16097-P (References 11-12). The list of changes included both Common Q hardware and software processes, and editorial changes. The staff performed a sample review of the changes and confirmed that the changes have not invalidated the previously derived safety conclusion.
- 4. Flat Panel Display System (WCAP-16097 PSAI 6.24): The staff reviewed the Licensees' evaluation to address the added reliance on the Flat Panel Display System (FPDS) to accomplish the required safety functions (see Reference 36). The staff found that the evaluation did not provide a discussion regarding the process to identify the three design basis events (DBE) that require operator action, and how the other DBEs screen out. This process needs to be documented in the evaluation. The Licensees agreed with the staff's request and will include this discussion in their response to the staff's RAI.
- 5. Quality Assurance Activities (WCAP-16096 PSAI 3): The NRC staff requested the Licensees to provide a summary in the proposed LARs on how their Quality Assurance Programs cover all the activities identified in WCAP-16096 PSAI 3. The Licensees agreed with the staff's request and will include this discussion in the disposition to WCAP-16096 PSAI 3.
- 6. Software Operations Plan (WCAP-16096 PSAI 4): The NRC staff requested the Licensees to add a discussion in the proposed LARs regarding the evaluation of compliance for the Software Operations Plan against the criteria of BTP 7-14, Section B.3.1.8.4. The Licensees agreed with the staff's request and will include this discussion in in the disposition to WCAP-16096 PSAI 4.
- 7. Software Verification and Validation Plan: The staff reviewed the AP1000 PMS Software Verification and Validation Plan (SVVP) (Reference 22). The staff confirmed that the resources for performing the independent verification and validation have been identified in the AP1000 PMS SVVP.

8. Software Development Plan: The staff gained a better understanding of the relationship of the Project Plan (Reference 17) and the Software Development Plan (Reference 16). The staff requested the Licensees to discuss in the response to the staff's RAI the relationship of Part 5 in the Project Plan with the Software Development Plan. The Licensees agreed with the NRC staff's request and will include this discussion in their response to the staff's RAI.
9. Configuration Control Board: The staff reviewed the AP1000 I&C Program Plan (Reference 17). This document added a description of the Configuration Control Board (CCB) process due to the proposed alternative to SPM Section 6.4, "SCM Schedule." The staff confirmed that the CCB process described in AP1000 I&C Program Plan does not contradict the CBB process in the Common Q SPM.
10. Pre-operational Test Program Test Plan: The staff reviewed the VEGP and VCSNS Pre-operational Test Program Test Plan (Reference 35). The staff found that the Pre-operational Test Program Test Plan did not reference IEEE Std.1012-1998, "IEEE Standard for Software Verification and Validation." The Licensees agreed to reference IEEE Std.1012-1998 in the Pre-operational Test Program Test Plan. Nevertheless, more work needs to be conducted by the Licensees to determine what verification and validation gaps had intruded into its pre-operational testing process since WEC stated no analysis or review towards this gap had been conducted.
11. Site Test Plan: In the proposed LARs, the Licensees are requesting an alternative to SPM Section 4.3.2.6, "Site Installation and Checkout Phase." The alternative proposes to initiate the preparation of the site test plan in accordance with the overall digital I&C test strategy to support installation testing and the Initial Test Program. The justification for this alternative states that the "site test planning is independent of any PMS development phase rather than the requirements phase."

During the audit, the staff reviewed the overall digital I&C test strategy (Reference 38) and the site test plan for the PMS (Reference 35). The staff confirmed that the site test plan was not initiated during the requirements phase (as required by the Common Q SPM). The staff's position continues to be that allowing the initiation of the Site Specific Acceptance Testing Plan to occur at any time during the PMS development phases rather than during the requirements phase relaxes the Common Q SPM requirement in a non-conservative manner. As such, this alternative would fall outside the acceptance criteria of IEEE Std.1012-1998 and the commitments in the Common Q SPM for the requirements phase, and potentially subsequent system development phases. For that reason, the staff fails to understand why the proposed alternative is appropriate. The Licensee agreed with the NRC staff's observation and will include this discussion in their response to the staff's RAI.

12. Compliance to Digital I&C Regulatory Guides: The Licensees requested in the proposed LARs to establish the Common Q SPM and TR as the licensing basis for the development of the Common Q portion of PMS in lieu of the applicable digital I&C regulatory guides (RG). However, the Licensees did not provide a discussion regarding

the relationship of the RG compliance to the SPM, as described in WCAP-15799, "AP1000 Compliance with SRP Acceptance Criteria."

The staff reviewed the evaluation of the Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59 change by VEGP associated with WCAP-15799 (Reference 39). The VEGP assessment for the removal of WCAP-15799 is inadequate. The 10 CFR 50.59 evaluation stated that WCAP-15799 has now been declared as an historical document. The staff found that the evaluation did not provide any written justification explaining how the removal of this document would not lessen or change any technical requirements/commitments regarding the design of SSCs within the scope of the FSAR. Because of this issue, the staff performed an evaluation to compare the Common Q processes with the applicable digital I&C RGs. The staff confirmed that the Common Q platform SPM and TR processes appear to be compatible with the guidelines of the digital I&C RGs. As a result, the staff believes that the proposed alternative in the LARs to be acceptable.

#### V. CONCLUSION

Based on the documentation that the NRC staff reviewed during the regulatory audit, the staff has gained a greater understanding of the design process changes and licensing documentation revisions for the proposed LARs. The NRC staff will use the results of this audit to support staff's efforts to complete their safety evaluation report for LAR-15-017 and LAR 13-35.

During the audit period, the NRC staff provided feedback to SNC/SCE&G personnel on topics that should be clarified in the proposed LARs and RAI responses. There were no new RAIs identified in the audit.

#### VI. LIST OF TECHNICAL AUDIT STAFF ATTENDEES

##### **Southern Nuclear Operating Company**

Bob Hirmanpour

##### **SCANA Corporation**

Randolph Copeland

Dean Kersey

April Rice

Ajay Tiwari

##### **Westinghouse**

Warren Odess-Gillett

Rick Paese

Matthew Shakun

## **United States Nuclear Regulatory Commission**

Luis Betancourt

David Curtis

Bill Gleaves

William Roggenbrodt

### **VII. REFERENCES**

#### **NRC Documentation:**

1. NRC letter to SNC, "Acceptance Review of Southern Nuclear Operating Company's Licensee Amendment Request (LAR-15-017) for the Vogtle Electric Generating Plant Units 3 and 4 – Common Qualified (Common Q) Platform Software Program Manual and Technical Report (CAC NO. RP9475)," March 22, 2016 (ADAMS Accession No. ML16076A362).
2. NRC letter to SCE&G, "Acceptance Review for Licensee Amendment Request for the Virgil C. Summer Nuclear Station Units 2 and 3: Update of Common Qualified (Common Q) Platform Software Program Manual and Topical Report (LAR 13-35) (CAC NO. RQ0463)," April 25, 2016 (ADAMS Accession No. ML16092A319).
3. NRC Audit Plan, "Update of Common Qualified Platform Software Program Manual and Topical Report (LAR-15-017 & LAR 13-35) Audit Plan," July 8, 2016 (ADAMS Accession No. ML16190A218).
4. NRO Office Instruction, NRO-REG-108, "Regulatory Audits," Revision 0, April 2009.
5. NUREG-0800, "Review of Safety Analysis Reports for Nuclear Power Plants," Chapter 7, "Instrumentation and Controls."

#### **Licensee and Vendor Documentation:**

6. Letter from Brian H. Whitley, Southern Nuclear Operating Company (SNC) to U.S. Nuclear Regulatory Commission (NRC), "Software Program Manual and Topical Report (LAR-13-017)," dated February 15, 2016 (ADAMS Accession No. ML16046A009).
7. Letter from April R. Rice, South Carolina Electric & Gas Company (SCE&G) to NRC, "VCSNS Units 2 & 3 LAR 13-35: Request for License Amendment: Update of Common Qualified (Common Q) Platform Software Program Manual and Topical Report," dated March 4, 2016 (ADAMS Accession No. ML16067A145).
8. WCAP-15927, "Design Process for AP1000 Common Q Safety Systems," Revision 3.
9. WCAP-15927, "Design Process for AP1000 Common Q Safety Systems," Revision 4.
10. WCAP-16096, "Software Program Manual for Common Q™ Systems," Revision 4.

11. WCAP-16097-P, "Common Qualified Platform Record of Changes," Appendix 5, Revision 2, October 2015.
12. WCAP-16097-P, "Common Qualified Platform Record of Changes," Appendix 5, Revision 3, July 2016.
13. WCAP-17266-P, "Common Qualified Platform Generic Change Process," Revision 1, October 2015.
14. WCAP-17201-P/APP-GW-GLR-148, "AC160 High Speed Link Communication Compliance to DI&C-ISG-04 Staff Positions 9, 12, 13, and 15 Technical Report," Revision 0, February 2010.
15. WNA-PC-0005-WAPP, "AP1000 I&C Projects Configuration Management Plan," Revision 5, June 2015.
16. WNA-PD-00042-WAPP, "AP1000 Protection and Safety Monitoring System Software Development Plan," Revision 11, September 2015.
17. WNA-PD-00051-WAPP, "AP1000 I&C Programs Plan," Project Plan, Revision 3.
18. WNA-PD-00283-WAPP, "U.S. AP1000 I&C Protection and Safety Monitoring System," Revision 5.
19. WNA-PQ-00283-WAPP, "AP1000 I&C Programs Project Quality Plan," Revision 6, June 2015.
20. WNA-PQ-00283-WAPP, "AP1000 I&C Programs Project Quality Plan," Revision 2, August 2013.
21. WNA-PQ-00283-WAPP, "AP1000 I&C Programs Project Quality Plan," Revision 1, August 2012.
22. WNA-PV-00054-WAPP, "AP1000 Protection and Safety Monitoring System Software Verification and Validation Plan," Revision 7, November 2015.
23. WNA-WI-00412-GEN, "Common Q RITS Work Instruction," Revision 3, March 2015.
24. VSG-PMS-T1-501, "Protection and Safety Monitoring System Preoperational Test Specification," Revision A.
25. APP-GW-GAP-341 (WEC 3.4.1), "AP1000 Plant Program Design Change Control," Revision 0.
26. APP-GW-GLR-017, "Resolution of Common Q NRC Items," Revision 2.
27. APP-GW-GAP-420, "Engineering and Design Coordination Reports," Revision 10.

28. APP-GW-GBH-361, "Westinghouse AP1000 Integrated I&C Test Strategy," Revision 2.
29. APP-PMS-J0-002, "AP1000 PMS Architecture Division A," Engineering Diagram.
30. APP-PMS-J0-003, "AP1000 PMS Architecture Division B," Engineering Diagram.
31. APP-PMS-J0-004, "AP1000 PMS Architecture Division C," Engineering Diagram.
32. APP-PMS-J0-004, "AP1000 PMS Architecture Division D," Engineering Diagram.
33. APP-PMS-J4-102, "AP1000 Protection and Safety Monitoring System Software Requirements Specification," Revision 16, July 2016.
34. APP-PMS-VBR-003/EQ-QR-205-APP, "Equipment Qualification Summary Report for PMS Cabinets and NIS Auxiliary Panels for Use in the AP1000 Plant," Revision 5, March 2016.
35. APP-GW-T5-501, "Vogtle and V.C. Summer Preoperational Test Program Test Plan," Revision 0.
36. Westinghouse Letter to R.M. Paese, "Plant Specific Action Item (PSAI) 6.24 – Evaluation to Address the Added Reliance on the Flat Panel Display System (FPDS) to Accomplish the Required Safety Functions," AFS-AP1000-SSFSE-15-025, August 1, 2016.
37. VEGP 3&4 – UFSAR, Chapter 17, Quality Assurance.
38. Southern Nuclear, "Nuclear Development Quality Assurance Manual," Version 14, November 24, 2015.
39. Letter from Southern Company, "Report of 10 CFR 50.59 Changes, Tests and Experiments and 10 CFR 52 Appendix D Departure Report," December 14, 2012. LDCR / Departure Number: 2012-062.
40. Commercial Dedication Instruction, "AC160 Nuclear Critical Components," CDI No. CDI-2625, Revision 25, November 3, 2015.
41. 10047D68, "AP1000 PMS EQ Communication Cable Configuration," Revision 4.
42. NA 4.28, "Request for Engineering Change," Revision 4.1.
43. NA 4.37, "Configuration Management," Revision 3.1.
44. W2-5.1-100 (WEC 16.2), "Westinghouse Corrective Action Program," Revision 0.
45. W2-7.2-101 (WEC 18.5), "External Audits and Regulatory Inspections", Revision 0.