



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 2, 2022

Mr. Daniel G. Stoddard
Senior Vice President and
Chief Nuclear Officer
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: SURRY POWER STATION, UNITS 1 AND 2 - REGULATORY AUDIT
SUMMARY RELATED TO THE LICENSE AMENDMENT REQUEST TURBINE
BUILDING WIND LOADING BASIS CHANGE (EPID L-2022-LLA-0056)

Dear Mr. Stoddard:

By letters dated April 14, 2022, and May 11, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML22104A125 and ML22131A326, respectively), Virginia Electric and Power Company, the licensee (Dominion Energy Virginia) submitted a license amendment request (LAR) for the Surry Power Station, Units 1 and 2 (Surry). The proposed amendment would approve a change in methodology and reclassify the turbine building as a tornado-resistant structure.

To enhance the review of the licensee's request, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a virtual audit of supporting documents from September 30, 2022, through October 26, 2022. The NRC staff audited the requested documents to: (1) examine and evaluate supporting analysis of information not included in the submittal(s), (2) increase the NRC staff's understanding of the LAR, and (3) identify any information that may require docketing to support the NRC staff's regulatory finding. A summary of the regulatory audit is enclosed, as well as the topics discussed during teleconferences held in support of the audit.

D. Stoddard

- 2 -

If you have any questions, please contact me at (301) 415-5136 or via email at John.Klos@nrc.gov.

Sincerely,

/RA/

John Klos, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-280 and 50-281

Enclosure:
Regulatory Audit Summary

cc: Listserv

REGULATORY AUDIT SUMMARY RELATED TO LICENSE AMENDMENT REQUEST
TO APPROVE A METHODOLOGY CHANGE AND RECLASSIFY THE TURBINE BUILDING
AS A TORNADO-RESISTANT STRUCTURE
VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION, UNIT NOS. 1 AND 2
DOCKET NOS. 50-280 AND 50-281

1.0 BACKGROUND

A regulatory audit is a planned license or regulation-related activity that includes the examination and evaluation of non-docketed information. This audit was conducted with the intent to: (1) examine and evaluate supporting analysis of information not included in the submittal(s), (2) increase the U.S. Nuclear Regulatory Commission (NRC) staff's understanding of the license amendment request (LAR), and (3) identify any information that may require docketing to support the NRC staff's regulatory finding.

By letters dated April 14, 2022, and May 11, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML22104A125 and ML22131A326, respectively), Virginia Electric and Power Company, the licensee (Dominion Energy Virginia) submitted a license amendment request (LAR) for the Surry Power Station, Units 1 and 2 (Surry). The proposed amendment would approve a change in methodology and reclassify the Turbine Building as a tornado-resistant structure.

The NRC staff performed a preliminary review of the LAR and determined that a regulatory audit would assist in reviewing the licensee's calculations supporting the LAR and timely completion of the review. The regulatory audit was performed consistent with NRC Office of Nuclear Reactor Regulation Office Instruction LIC-111, Revision 1, "Regulatory Audits," dated October 31, 2019 (ADAMS Accession No. ML19226A274).

2.0 AUDIT ACTIVITIES

The NRC staff conducted a regulatory audit that consisted of a document review via the licensee's electronic room portal (erom) and a series of virtual teleconferences. An audit plan was provided to the licensee by letter dated September 15, 2022 (ML22250A467), which contained the subject areas, an outlined schedule, and logistics for the audit. Additional audit team members and amendment audit scope were added to the NRC staff's review team by letter dated October 3, 2022 (ML22277A725).

The list of documents sent to the licensee's erom by the licensee that were examined by the audit team is provided in Section 4.0 below and the discussion topics that were part of the two video teleconferences are included in the Enclosure.

Audit activities for each subject area are summarized below.

Probability Risk Insights Review

The NRC staff reviewed the audit documents to assess the details associated with:

1. Procedures governing the safe shutdown of the plant after a tornado, including a potential roof collapse scenario.
2. Availability of equipment required to achieve and maintain safe shutdown conditions after a potential roof collapse scenario.
3. Qualitative or quantitative risk insights based on the evaluation of a potential roof collapse scenario and their impact on the application.
4. The systems, structures and components in the turbine building basement that were evaluated by the Tornado Missile Risk Evaluator methodology (ML18347A385) that was adopted for plant-specific use by the licensee using 10 CFR 50.59.

Civil and Structural Review

The NRC staff reviewed the audit documents to assess detailed information concerning:

1. The engineering assumptions, methodology, industry standards/codes, input variables and related calculations and outputs/results that support the amendment's accountability for tornado missile effects and the turbine building's wind load basis change.
2. The missile types considered, the applied loads, roof collapse scenarios and the related dynamic load factors, the stress-strain curve development for A36 carbon steel, and siding failure basis, and the license amendment's change in wind load.

3.0 AUDIT TEAM

The NRC audit team members:

- George Wang, Civil Engineer, George.Wang@nrc.gov
- Bryce Lehman, Civil Engineer, Bryce.Lehman@nrc.gov
- John Klos, Surry Licensing Project Manager, John.Klos@nrc.gov
- Steven Alferink, Reliability and Risk Analyst, Steven.Alferink@nrc.gov
- De Wu, Reliability and Risk Analyst, De.Wu@nrc.gov
- Shilp Vasavada, Branch Chief, Shilp.Vasavada@nrc.gov.

4.0 DOCUMENTS EXAMINED BY STAFF VIA THE LICENSEE'S EROOM

1. Calculation number 0114-0126-CALC-001, "Surry Turbine Building Superstructure Evaluation for Tornado Wind Loads," Revision 1.
2. Document number ETE-CCE-2020-0003, "Technical Basis to Support Reducing the Tornado Wind Speeds for the Surry Turbine Building," Revision 2.
3. Surry Drawing 11448-FC-2B, "Foundation Details Sh.1 Turbine Building Part 1," Revision 5.
4. Surry Drawing 11448-FC-7A, "Operating Floor Slab Elevation 58'-6" Turbine Building, Surry Power Station – Unit 1," Revision 7.
5. Surry Drawing 11448-FC-8B, "Mezzanine Floor Slab Elevation 27'-0" & Elevation 35'-0" Turbine Building, Surry Power Station," Revision 6.

6. Surry Drawing 11448-FC-7C, "Operating & Mezzanine Floor Slab Dets, Turbine Building," Revision 2.
7. Surry Drawing 11448-FC-7F, "Miscellaneous Details Turbine Building, Surry Power Station – Unit 1," Revision 4.
8. Surry Drawing 11448-FS-1A, "Column Location Plan Turbine & Service Building," Revision 6.
9. Surry Drawing 11448-FS-1B, "Column Schedule & Base Details, Turbine & Service Building Surry Power Station – Unit 1," Revision 8.
10. Surry Drawing 11448-FS-2A, "Mezzanine Floor Framing. Turbine Building, Surry Power Station – Unit 1," Revision 20.
11. Surry Drawing 11448-FS-2B, "Mezzanine Floor Framing. – Sh. 2 – Turbine Building," Revision 6.
12. Surry Drawing 11448-FS-2C, "Mezzanine Floor Framing – Sh. 3 – Turbine Building," Revision 4.
13. Surry Drawing 11448-FS-2E, "Mezzanine Floor Framing Turbine Building Surry Power Station – Unit 1," Revision 5.
14. Surry Drawing 11448-FS-2G, "Mezzanine Floor Framing Turbine Building Surry Power Station – Unit 1," Revision 3.
15. Surry Drawing 11448-FS-3A, "Operating Floor Framing Turbine Building Surry Power Station – Unit 1," Revision 14.
16. Surry Drawing 11448-FS-3B, "Operating Floor Framing Elevation 58'-6" - Sh. 2 – Turbine Building," Revision 3.
17. Surry Drawing 11448-FS-3C, "Operating Floor Framing – Sh. 3 – Turbine Building," Revision 1.
18. Surry Drawing 11448-FS-3D, "Operating Floor Framing – Sh. 4 – Turbine Building," Revision 3.
19. Surry Drawing 11448-FS-4A, "Turbine Room Roof Sh. 1," Revision 2.
20. Surry Drawing 11448-FS-4B, "Turbine Room Roof Sh. 2," Revision 2.
21. Surry Drawing 11448-FS-4C, "Turbine Room Roof Details," Revision 3.
22. Surry Drawing 11448-FS-4D, "Crane Girders & Details Turbine Building," Revision 3.
23. Surry Drawing 11448-FS-10A, "Cross Sections Sh. 1 Turbine & Service Building," Revision 4.
24. Surry Drawing 11448-FS-11A, "Elevation 'B' & 'C' Lines Turbine & Service Building," Revision 8.
25. Surry Drawing 11448-FS-17A, "Roof Framing Plan Service Building, Surry Power Station – Unit 1 & 2," Revision 12.
26. Surry Drawing 11448-FS-17C, "Service Building Steel Framing Elevations 42'-0", 47'-0" & 58'-6" Surry Power Station – Unit 1 & 2," Revision 13.
27. Surry Drawing 11448-FS-17S, "Service Building Steel Framing – Elevation 42'-0", Surry Power Station – Unit 1," Revision 0.
28. Surry Drawing 11448-FS-17T, "Roof Framing Plan Service Building Surry Power Station – Unit 1," Revision 1.
29. Surry Drawing 11448-FS-2D, "Heater Guides Elevation 35'-0" Mezzanine Floor Turbine Building Surry Power Station – Unit 1," Revision 5.

30. Surry Drawing 11548-FC-7A, "Operating Floor Slab Elevation 58'-6" Turbine Building, Surry Power Station – Unit 2," Revision 8.
31. Surry Drawing 11548-FC-7B, "Mezzanine Floor Slab Elevation 27'-0" Turbine Building, Surry Power Station – Unit 2," Revision 2.
32. Surry Drawing 11548-FS-2A, "Mezzanine Floor Framing Turbine Building, Surry Power Station – Unit 2," Revision 18.
33. Surry Drawing 11548-FS-2B, "Mezzanine Floor Framing – Sh. 2 – Turbine Building," Revision 4.
34. Surry Drawing 11548-FS-2C, "Mezzanine Floor Framing – Sh. 3 – Turbine Building," Revision 3.
35. Surry Drawing 11548-FS-3A, "Operating Floor Framing Turbine Building, Surry Power Station – Unit 2," Revision 12.
36. Surry Drawing 11548-FS-3B, "Operating Floor Framing Elevation 58'-6" - Sh. 2 – Turbine Building," Revision 3.
37. Surry Drawing 11548-FS-3C, "Operating Floor Framing Turbine Building Surry Power Station – Unit 2," Revision 5.
38. Surry Drawing 11548-FS-3D, "Operating Floor Framing – Sh. 4 – Turbine Building," Revision 2.
39. Surry Drawing 11548-FS-4A, "Turbine Room Roof Sh. 1," Revision 4.
40. Surry Drawing 11548-FS-4B, "Turbine Room Roof Sh. 2," Revision 3.
41. Surry Drawing 11548-FS-4C, "Turbine Room Roof Details," Revision 4.
42. Surry Drawing 11548-FS-10A, "Cross Sections Sh. 1 Turbine & Service Building," Revision 2.
43. Procedure 1-E-0, "Reactor Trip or Safety Injection," Revision 79
44. Procedure 1-OP-FW-006, "Filling Emergency Condensate Tanks 1-CN-TK-1 and 1-CN-TK-3," Revision 6
45. Procedure 2-E-0, "Reactor Trip or Safety Injection," Revision 82
46. Procedure 2-OP-FW-006, "Filling Emergency Condensate Tanks 2-CN-TK-1 and 2-CN-TK-3," Revision 6

5.0 TELECONFERENCE DISCUSSION POINTS OF THE AUDIT

October 6, 2022, Audit Teleconference

This teleconference was held to formally add and introduce licensee representatives to the NRC audit team. The teleconference also reviewed the additional audit scope that would be reviewed (see Section 2.0 above) by letter dated October 3, 2022 (ML22277A725).

October 18, 2022, Audit Teleconference

The following civil and structural items were discussed after the NRC staff completed its review of the licensee's eroom.

1. Explain how safety-related structures, systems, and components within the turbine building are protected from the tornado generated missiles after the Turbine Building Steel Superstructure (TBSS) collapses during the postulated tornado wind event.
2. The LAR notes that the impact of the falling roof structure on the operating deck was addressed by adding a distributed weight across the operating floor. No discussion is provided about the possibility of a perforation of the operating deck slab or grating. Provide the evaluation of potential impacts of the overhead cranes on local effects (i.e.,

perforation) of the operating deck or supporting grating, and on the safety-related components and systems within the Turbine Building after the TBSS collapses during the postulated tornado wind event.

3. LAR, Section 3.3.1.2 states “A true-stress, true-strain curve for carbon steel was developed based on the method provided in Section VIII, Division 2 of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code ... using the design basis ASTM A36 material strength and properties.” Updated Final Safety Analysis Report planned changes in the LAR, attachment, state that “... Nonlinear material acceptance criteria are based on the applicable requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Division 2, 2010 Edition ...” Provide the justification for why it is acceptable to use the methodology provided in Section VIII, Division 2 of the ASME Boiler and Pressure Vessel Code in developing the stress-strain curve for A36 carbon steel in the analysis of the Turbine Building.
4. Explain how the operating floor is designed for the tornado wind uplift after the TBSS collapses during the postulated tornado wind event.
5. LAR Section 3.3.1.4 utilizes the acceptance criteria to evaluate steel members of the turbine building to ensure steel members are within their ultimate strength design limit. LAR Section 3.3.1.4 utilizes the acceptance criteria that composite reinforced concrete stress is limited to the concrete compressive strength. Clarify the codes used for the design of steel and concrete in the turbine building.
6. Further explain the lateral resistant structural system and its evaluation.
7. The LAR Section 3.3.2.3 states “the analysis results indicated the maximum shear stresses exceed the shear capacity of the concrete alone only at highly localized areas on the operating floor. These localized exceedances will not cause gross failure of the concrete floor since any excessive load would be redistributed into the more ductile rebar and surrounding steel.” The staff reviewed via the erom “Surry Turbine Building Superstructure Evaluation for Tornado Wind Loads” (Calculation Number: 0114-0126-CALC-001, Revision 1), and found that the ratio of the maximum shear stress (426 psi) over the shear capacity of the concrete alone (123 psi) equals to 3.46. Provide the justification how this excessive shear load can be resisted by the rebar and surrounding steel.

Provide the evaluation of reinforcing steel in the concrete, including the ratio of maximum compressive or tensile strength over their compressive or tensile capacity of the reinforcing steel.

The following risk insights review items were discussed after the NRC staff completed its review of the licensee’s erom.

1. A discussion of Surry’s feed pump configuration, operator actions that would support a safe shutdown, and discussion of the PRA summaries provided in the licensee’s erom.

6.0 AUDIT CONCLUSION

The audit was closed on October 26, 2022. The detailed discussion on October 18, 2022, revealed the licensee's intention to supplement the license amendment. The NRC staff's review of the proposed license amendment continues and a request for additional information may be issued as needed.

SUBJECT: SURRY POWER STATION, UNITS 1 AND 2 - REGULATORY AUDIT SUMMARY
 RELATED TO THE LICENSE AMENDMENT REQUEST TURBINE BUILDING
 WIND LOADING BASIS CHANGE (EPID L-2022-LLA-0056)
 DATED DECEMBER 2, 2022

DISTRIBUTION:

PUBLIC

LPL2-1 R/F

RidsAcrg_MailCTR Resource

RidsNrrDorlLpl2-1 Resource

RidsNrrLAKGoldstein Resource

RidsNrrPMSurry Resource

RidsRgn2MailCenter Resource

RidsNrrDexEseb

RidsNrrDraAplc

DJohnson, OEDO

DWu, NRR

GWang, NRR

SAIferink, NRR

ADAMS Accession No.: ML22313A159***by email**

| | | | |
|--------|--------------------|------------------------|--------------------|
| OFFICE | NRR/DORL/LPL2-1/PM | NRR/DORL/LPL2-1/LA* | NRR/DEX/ESEB/BC* |
| NAME | JKlos | KGoldstein (KEntz for) | JColaccino |
| DATE | 11/08/2022 | 11/10/2022 | 11/15/2022 |
| OFFICE | NRR/DRA/APLC/BC* | NRR/DORL/LPL2-1/BC* | NRR/DORL/LPL2-1/PM |
| NAME | SVasavada | MMarkley | JKlos |
| DATE | 11/17/2022 | 12/01/2022 | 12/02/2022 |

OFFICIAL RECORD COPY