UNITED STATES
NUCLEAR REGULATORY COMMISSION
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April 3, 2018

MEMORANDUM TO: Jennifer Dixon-Herrity, Chief
Licensing Branch 4
Division of New Reactor Licensing
Office of New Reactors

FROM: Paul Kallan, Senior Project Manager ***/RA***/
Licensing Branch 4
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: AUDIT REPORT FOR VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4, REQUEST FOR LICENSE AMENDMENT AND EXEMPTION: IMPROVEMENTS TO MAIN CONTROL ROOM POST-ACCIDENT RADIOLOGICAL CONSEQUENCES (LAR 17-023)

By letter dated August 31, 2017 (Agencywide Documents Access and Management System (ADAMS Accession No. ML17243A351), and supplemented by letter dated February 9, and March 8, 2018 (ADAMS Accession Nos. ML18040A487 and ML18067A648), (Southern Nuclear Operating Company (the licensee) requested an amendment to Combined License (COL) Numbers NPF-91 and NPF-92, for Vogtle Electric Generating Plant Units 3 and 4.

The requested amendment proposed to depart from Tier 2 information in the Updated Final Safety Analysis Report (which includes the plant-specific design control document Tier 2 information) and involves related changes to plant-specific Tier 1 (and associated COL Appendix C) information and COL Appendix A Technical Specifications.

The requested amendment proposes changes to the plant-specific nuclear island non-radioactive ventilation system, the main control room emergency habitability system, and post-accident operator dose analyses. The changes propose to maintain compliance with General Design Criterion (19), “Control Room Habitability,” which requires that main control room (MCR) personnel dose does not exceed 5 roentgen equivalent man (rem) total effective dose equivalent for the duration of a design basis accident.

CONTACT: Paul Kallan, NRO/DNRL/LB4
301-415-2809

As such, the Radiation Protection and Accident Consequences Branch staff conducted an audit on March 7-8, 2018, to gain a better understanding of the proposed changes in order to reach reasonable findings and review related documentation and non-docketed information to evaluate conformance with the Standard Review Plan or technical guidance.

Docket Nos.: 52-025 and 52-026

Enclosure:
Regulatory Audit Plan

cc: See next page

AUDIT REPORT FOR VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4, REQUEST FOR LICENSE AMENDMENT AND EXEMPTION: IMPROVEMENTS TO MAIN CONTROL ROOM POST-ACCIDENT RADIOLOGICAL CONSEQUENCES (LAR 17-023) DATE APRIL 3, 2018

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ADAMS Accession No.: ML18072A318 **NRO-008**

OFFICE	DNRL/LB4/PM	DNRL/LB4/LA	DNRL/LB4/BC
NAME	PKallan	RButler	JDixon-Herrity
DATE	4/2/18	3/29/18	4/3/18

OFFICIAL RECORD COPY

Vogtle Units 3 & 4 Mailing List (Revised 3/9/2018)

cc:

Office of the Attorney General
40 Capitol Square, SW
Atlanta, GA 30334

Resident Manager
Oglethorpe Power Corporation
Alvin W. Vogtle Nuclear Plant
7821 River Road
Waynesboro, GA 30830

Southern Nuclear Operating Company
Document Control Coordinator
42 Inverness Center Parkway, Bin 237
Birmingham, AL 35242

Anne F. Appleby
Olgethorpe Power Corporation
2100 East Exchange Place
Tucker, GA 30084

County Commissioner
Office of the County Commissioner
Burke County Commission
Waynesboro, GA 30830

Mr. Wayne Guilfoyle
Commissioner District 8
Augusta-Richmond County Commission
4940 Windsor Spring Rd
Hephzibah, GA 30815

Gwendolyn Jackson
Burke County Library
130 Highway 24 South
Waynesboro, GA 30830

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
Atlanta, GA 30334

Resident Inspector
Vogtle Plant Units 3 & 4
8805 River Road
Waynesboro, GA 30830

Mr. Barty Simonton
Team Leader
Environmental Radiation Program
Air Protection Branch
Environmental Protection Division
4244 International Parkway, Suite 120
Atlanta, GA 30354-3906

George B. Taylor, Jr.
2100 East Exchange Pl
Atlanta, GA 30084-5336

Brian H. Whitley
Regulatory Affairs Director
Southern Nuclear Operating Company
42 Inverness Center Parkway, BIN B237
Birmingham, AL 35242

Mr. Michael Yox
Site Regulatory Affairs Director
Vogtle Units 3 & 4
7825 River Road, Bin 63031
Waynesboro, GA 30830

Vogtle Units 3 & 4 Mailing List

Email

acchambe@southernco.com (Amy Chamberlian)
agaughtm@southernco.com (Amy Aughtman)
ALPUGH@southernco.com (Amanda Pugh)
awc@nei.org (Anne W. Cottingham)
becky@georgiawand.org (Becky Rafter)
bhwhitley@southernco.com (Brian Whitley)
Bill.Jacobs@gdsassociates.com (Bill Jacobs)
bjadams@southernco.com (Brad Adams)
bwwaites@southernco.com (Brandon Waites)
castelca@westinghouse.com (Curtis Castell)
comerj@westinghouse.com (James Comer)
crenshjw@westinghouse.com (John Crenshaw)
crpierce@southernco.com (C.R. Pierce)
dahjones@southernco.com (David Jones)
david.hinds@ge.com (David Hinds)
david.lewis@pillsburylaw.com (David Lewis)
dgbost@southernco.com (Danny Bost)
dlfulton@southernco.com (Dale Fulton)
drculver@southernco.com (Randy Culver)
durhamdc@westinghouse.com (David Durham)
ed.burns@earthlink.net (Ed Burns)
edavis@pegasusgroup.us (Ed David)
erg-xl@cox.net (Eddie R. Grant)
fdhundle@southernco.com (Forrest Hundley)
fhwillis@southernco.com (Fred Willis)
G2NDRMDC@southernco.com (SNC Document Control)
graysw@westinghouse.com (Scott W. Gray)
jadwilli@southernco.com (J.D. Williams)
james1.beard@ge.com (James Beard)
jannina.blanco@pillsburylaw.com (Jannina Blanco)
jantol1dj@westinghouse.com (David Jantosik)
jenmorri@southernco.com (Jennifer Buettner)
JHaswell@southernco.com (Jeremiah Haswell)
jim@ncwarn.org (Jim Warren)
John.Bozga@nrc.gov (John Bozga)
Joseph_Hegner@dom.com (Joseph Hegner)
jpredd@southernco.com (Jason R. Redd)
jranalli@meagpower.org (Jerry Ranalli)
jtgasser@southernco.com (Jeff Gasser)
karen.patterson@ttnus.com (Karen Patterson)
karlg@att.net (Karl Gross)
kdfili@southernco.com (Karen Fili)
kmstacy@southernco.com (Kara Stacy)
KSutton@morganlewis.com (Kathryn M. Sutton)

Vogtle Units 3 & 4 Mailing List

kwaugh@impact-net.org (Kenneth O. Waugh)
lchandler@morganlewis.com (Lawrence J. Chandler)
Marc.Pickering@hq.doe.gov (Marc Pickering)
markus.popa@hq.doe.gov (Markus Popa)
mdmeier@southernco.com (Mike Meier)
media@nei.org (Scott Peterson)
Melissa.Smith@Hq.Doe.Gov (Melissa Smith)
Michael.Kuca@hq.doe.gov (Michael Kuca)
mike.price@opc.com (M.W. Price)
MKWASHIN@southernco.com (MKWashington)
mlgraves@southernco.com (Michelle Graves)
MSF@nei.org (Marvin Fertel)
myox@southernco.com (Mike Yox)
nirsnet@nirs.org (Michael Mariotte)
Nuclaw@mindspring.com (Robert Temple)
patriciaL.campbell@ge.com (Patricia L. Campbell)
Paul@beyondnuclear.org (Paul Gunter)
pbessette@morganlewis.com (Paul Bessette)
r.joshi15@comcast.net (Ravi Joshi)
rjarrett@southernco.com (Robyn Jarrett)
RJB@NEI.org (Russell Bell)
Ronald.Jones@scana.com (Ronald Jones)
rwink@ameren.com (Roger Wink)
sabinski@suddenlink.net (Steve A. Bennett)
sara@cleanenergy.org (Sara Barczak)
sblanton@balch.com (Stanford Blanton)
Shiva.Granmayeh@hq.doe.gov (Shiva Granmayeh)
sjackson@meagpower.org (Steven Jackson)
skauffman@mpr.com (Storm Kauffman)
sroetger@psc.state.ga.us (Steve Roetger)
stephan.moen@ge.com (Stephan Moen)
stephen.burdick@morganlewis.com (Stephen Burdick)
tom.miller@hq.doe.gov (Tom Miller)
TomClements329@cs.com (Tom Clements)
Vanessa.quinn@dhs.gov (Vanessa Quinn)
vcsummer2n3@gmail.com (Brian McIntyre)
wasparkm@southernco.com (Wesley A. Sparkman)
wayne.marquino@gmail.com (Wayne Marquino)
weave1dw@westinghouse.com (Doug Weaver)
x2gabeck@southernco.com (Gary Becker)
x2kmseib@southernco.com (Kristin Seibert)

REPORT OF REGULATORY AUDIT
LICENSE AMENDMENT RELATED TO
IMPROVEMENTS TO MAIN CONTROL ROOM POST-ACCIDENT
RADIOLOGICAL CONSEQUENCES
VOGTLE ELECTRIC GENERATING PLANT, UNITS 3 AND 4 (LAR 17-023)

A. Background

By letter dated August 31, 2017, (Agencywide Documents Access and Management System (ADAMS Accession No. ML17243A351), and supplemented by letter dated February 9, and March 8, 2018 (ADAMS Accession Nos. ML18040A487 and ML18067A648), Southern Nuclear Operating Company, 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.

As part of the LAR, the licensee proposes to depart from Tier 2 information in the Updated Final Safety Analysis Report (which includes the plant-specific design control document (DCD) Tier 2 information) and involves related changes to plant-specific Tier 1 (and associated COL Appendix C) information and COL Appendix A, Technical Specifications.

The requested amendment proposes changes to the plant-specific ventilation system (VBS), the main control room emergency habitability system (VES), and post-accident operator dose analyses. The changes propose to maintain compliance with General Design Criterion (19), which requires that main control room (MCR) personnel dose does not exceed 5 roentgen equivalent man (rem) total effective dose equivalent for the duration of a design basis accident (DBA). The NRC staff determined that an audit of the reports and calculations supporting this LAR is the appropriate method to verify this proposed change maintains compliance with Title 10 of *Code of Federal Register* (10 CFR) 50.34(f)(2)(vii) which requires shielding and design reviews necessary to permit adequate access to important areas rather than by issuing multiple rounds of requests for additional information (RAIs).

B. Bases

This regulatory audit is based on the following:

- 10 CFR 50.34(f)(2)(vii) requires the performance of radiation and shielding design reviews of spaces around systems that may, as a result of an accident, contain accident source term radioactive materials, and design as necessary to permit adequate access to important areas and to protect safety equipment from the radiation environment.

- NRO Office Instruction NRO-REG-108 (Revision 0), “Regulatory Audits,” (ADAMS Accession No. ML081910260) in performing the audit of the reports and calculations cited below.

The audit plan is available in ADAMS under Accession No. ML18058A090.

C. Audit Location and Dates

Location: The audit was conducted at Westinghouse Electric Company's (Westinghouse) (the licensee's vendor) office at 11333 Woodglen Drive Suite 202, Rockville, Maryland 20852.

Date: March 7-8, 2018.

D. Audit Team Members

The following NRC staff members participated in substantive discussions during the audit:

Paul Kallan, Senior Project Manager (Licensing Branch 4)
Ronald LaVera, Health Physicist (Radiation Protection and Accident Consequences Branch)

E. Applicant and Industry Staff Participants

Neil Haggerty (via telephone)
Zachary Harper
Jesse Klingensmith (via telephone)
Aaron Wilmot
Anthony Schoedel
Bobby Pinkston

F. Documents Audited

- "AP1000 – Containment Penetration and Direct Dose Evaluation Outside Containment in Post Accident Conditions," APP-SSAR-GSC-722, Revision 3
- "AP1000 – Dose Evaluation for Vital Area Access Outside Containment in Post-Accident Conditions," APP-SSAR-GSC-723, Revision 3
- "AP1000 – Radiation Zoning Inside Annex Building in Post Accident Conditions," APP-SSAR-GSC-108, Revision 2
- "AP1000 – Source Distribution Inside Auxiliary and Annex Building as a Function of Time Following a Design Basis LOCA [Loss of Coolant Accident]," APP-GW-N1C-001, Revision 1
- "AP1000 – Dose Rates Due to the Cloud Inside Auxiliary Building in Post Accident LOCA Conditions," APP-SSAR-GSC-721, Revision 1
- "Nuclear Island General Arrangement Plan at El 117' 6"," APP-1040-P2-001, Revision 5

G. Description of Audit Activities and Summary of Observations

The purpose of the Westinghouse audit was for the staff to review calculations describing the methods, models, and assumptions used to determine the dose to personnel moving the MCR Ancillary Fans (AF) following an accident involving a LOCA. This dose analysis is used by the staff

to determine whether the licensee complies with 10 CFR 50.34(f)(2)(vii) which requires shielding and design reviews necessary to permit adequate access to important areas.

In conducting the audit, the staff focused on the dose accrued in Room 12412 which is identified as Electrical Penetration Room Division A, because a new post-accident mission to this area was described in LAR-17-023. The staff compared the information provided by the licensee in Table 3-1 "Inputs and Assumptions Used to Assess Operator Dose for the Vital Area Action of Retrieving the MCR Ancillary Fans in Postulated Post-Accident Conditions," and Table 3-2 "Results of Radiation Protection Calculations for Operator Dose to Access and Transport Retrieving the MCR Ancillary Fans in Postulated Post-Accident Conditions," of "Southern Nuclear Operating Company Vogtle Electric Generating Plant Units 3 and 4 Supplement to Request for License Amendment and Exemption Regarding Improvements to Main Control Room (MCR) Post-Accident Radiological Consequences (LAR-17-023S1)," (ADAMS Accession No. ML18040A487) to the information contained within the calculation packages described above. The following discussions address specific statements, assumptions or analytical results provided by the licensee.

The staff reviewed the basis for the "Dose Rate in Room 12421" of 0.090 rem/hour (hr) shown in LAR-17-023S1 Table 3-2. By reviewing "Nuclear Island General Arrangement Plan at El 117' 6"," APP-1040-P2-001, the staff was able to determine that the location where the AFs are stored is well away from the direct radiation streaming paths from the Containment through the electrical penetrations into Room 12412 that are shown on "AP1000 Design Control Document (DCD), Figure 1.2-9 Nuclear Island General Arrangement Plan at Elevation 117′-6″ with Equipment," Revision 19. The information about the storage location of the AFs helped to reduce the mission dose estimated by the staff.

The staff was able to determine that the dose rate for Room 12411, shown in LAR-17-023S1 Table 3-2, was due to radiation shine from the electrical penetrations in Room 12421 "Non 1E Equipment/Penetration Room," and not Room 12412, thus providing assurance that the AF were not stored in an area directly adjacent to a penetration which could result in higher mission dose.

The staff reviewed the method used by the licensee to adjust the direct dose rate in Room 12412 in the vicinity of the AF to account for decay of radionuclides released at the start of the accident, to the time at 70 hours following the accident when access to the AFs was required. The staff asked the licensee to describe the basis of the dose rate of 0.090 rem/hr listed in LAR-17-023S1 Table 3-2. The licensee stated that they used the ratio of the dose rates in the MCR at the peak value of radioactive material early in the accident (at approximately 1.97 hours) and the dose rates in the MCR at about 70 hours to perform the decay adjustment of the dose rate in Room 12412. The licensee stated that one part of the basis for the selection of this method was that the post-accident radiation spectrum would change with time, thus improving the relative efficiency of the shielding material. The staff acknowledged that the change in radiation spectrum as it traversed the shielding material would make the shielding material more effective. However the staff determined through independent calculations that the adjustment from this factor would be much less than that assumed by the licensee. While this could result in a higher dose estimate for the mission, as discussed below, due to the margin available between the dose limit and the estimated mission dose, the staff finds this acceptable.

When performing the calculation to compare the dose rate ratios at 1.97 hours and 70 hours as noted above, the staff used the energy spectra described in AP1000 DCD Revision 19, Table 12.2-20 "Core Melt Accident Source Strengths in Containment Atmosphere as a Function of Time." Use of Table 12.2-20 would result in higher mission dose estimates due to the higher containment activity concentrations needed to cause the energy increases described in Table 12.2-20. In

response, the licensee stated that another part of the basis for the apparent difference in the post-accident dose rate adjustments made by the licensee and the staff was that because of some additional removal mechanisms identified in the precedence cited in the August 2017 LAR-17-023 submittal, the activity values used were lower than those used to derive the data shown in DCD Table 12.2-20. The use of the additional removal factors was approved by the staff in the precedence cited by the licensee. The use of the additional removal factors also reduced the estimated mission dose and is acceptable.

The staff also reviewed the basis for the radiation exposure due to the inhalation of radioactive material identified in LAR-17-023S1 Table 3-2. The amount of airborne radionuclides that may be present following an accident could result in personnel exceeding the dose limits described in 10 CFR 50.34(f)(2)(vii), so the use of respiratory protection equipment is required to maintain dose within the limits. The use of respiratory protection equipment to satisfy the requirement of 10 CFR 50.34(f)(2)(vii) is not identified in DCD Subsection 12.4.1.8 "Post-Accident Actions." Table 3-2 provides doses from inhalation based on the use of respiratory protection equipment. APP-SSAR-GSC-721 states that providing the analysis for an Assigned Protection Factor (APF) of 50, allows applicants to not be locked into the use of Self Contained Breathing Apparatus (SCBA) to perform vital post-DBA functions. The value of 50 corresponds to the use of an airline fed half-face respirator. The staff identified that the licensee does not have an installed breathing air system capable of supporting the application of a protection factor of 50. The licensee agreed with the staff observation that due to the lack of an installed breathing air system an APF of 50 could not be used. The licensee discussed with the staff the possible use of APFs for iodine specific sorbent cartridges. However because the licensee had not applied to the Commission for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors (e.g., radioiodine), the only other available option to limit the inhalation of radionuclides was the use of SCBAs.

H. Exit Briefing

The NRC staff's exit briefing for the audit was conducted on the morning of March 8, 2018. The licensee and NRC staff discussed the information provided to the staff by the licensee during the audit, and subsequent the observations made by the staff during the audit. The staff indicated that the licensee provided all of the information, within the scope of the audit, needed by the staff.

The following are the key observations identified by the staff during the audit:

- The staff determined that respiratory protection equipment is required to demonstrate compliance with 10 CFR 50.34(f)(2)(vii). The licensee's Final Safety Analysis Report Subsection 12.4.1.8, should reflect the need for the use of respiratory protection equipment as part of the dose analysis for the identified missions. The licensee stated that they would evaluate the suggestion by the staff.

- The staff determined that if appropriate respiratory protection equipment (such as SCBAs) is used, the mission to relocate the AFs can be performed within the requirements of 10 CFR 50.34(f)(2)(vii). The licensee noted this observation.

- The staff determined that based on the margin between the calculated dose and the limits used to assess compliance with 0 CFR 50.34(f)(2)(vii), the methods used by the licensee (as described above) were adequate for the purposes of this evaluation. The staff also identified to the licensee and Westinghouse that the non-conservative nature of the adjustment methods could cause issues with Equipment Qualification and other post-

accident vital area missions, which were beyond the scope of this audit, but may be germane to future reviews. The licensee noted this observation.

- The staff determined that Table 12.2-20 should be updated. As such the staff discussed with the licensee the use of activity values that differ from those contained in Table 12.2-20 to calculate dose for the relocation of the Ancillary Fans. The licensee stated that although they believed that this topic was already addressed, they would consider the staff suggestion to include modification of Table 12.2-20 as part of this application.

I. RAIs Resulting from Audit

No RAIs were asked as a result of this audit.

J. Open Items and Proposed Closure Paths

No open items were identified as a result of the audit.

K. Deviations from the Audit Plan

No deviations from the audit plan were identified or required.

L. References

1. "Request for License Amendment and Exemption Regarding Improvements to Main Control Room (MCR) Post-Accident Radiological Consequences (LAR 17-023)," August 31, 2017 (ADAMS Accession No. ML17243A352 and ML17243A353.

2. "Southern Nuclear Operating Company Vogtle Electric Generating Plant Units 3 and 4 Supplement to Request for License Amendment and Exemption Regarding Improvements to Main Control Room (MCR) Post-Accident Radiological Consequences (LAR-17-023S1)," February 9, 2018, (ADAMS Accession No. ML18040A487).

3. U.S. Nuclear Regulatory Commission Audit Plan for Vogtle Electric Generating Plant Units 3 and 4 Request for License Amendment And Exemption: Improvements To Main Control Room (MCR) Post-Accident Radiological Consequences (LAR 17-023), February 28, 2018 (ADAMS Accession No. ML18058A090).

4. NRO-REG-108, "Regulatory Audits," April 2, 2009 (ADAMS Accession Number ML081910260).

5. AP1000 Design Control Document, Revision 19, June 13, 2011 (ADAMS Accession No. ML11171A500).