

# REPORT OF REGULATORY AUDIT ON THE CALCULATIONS ON HYDROGEN GAS GENERATION IN THE RADWASTE BUILDING BUNKERS

## Related to Virgil C. Summer Nuclear Station, Units 2 and 3 Licensing Amendment Request (LAR 13-09)

### A. Background

By letter dated February 27, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML14065A022), South Carolina Electric & Gas (the licensee) requested an amendment to Combined License Numbers NPF-93 and NPF-94, for Virgil C. Summer Nuclear Station Units 2 and 3 (License Amendment Request (LAR) 13-09). The proposed amendment has been modified numerous times since the original submittal, including Revision 1, submitted December 17, 2015 (ADAMS Accession Number ML15351A428) and Revision 1, Supplement 1, submitted June 1, 2016 (ADAMS Accession Number ML16154A048), with a planned Revision 1, Supplement 2, to be submitted in the coming months. The proposed amendment would revise the Updated Final Safety Analysis Report in the form of departures from the plant-specific Licensing Basis Documents that include changes to the Radwaste Building design. This amendment includes adding bunkers in the Waste Accumulation Room which is located in the Radwaste Building. The bunkers will be used for storing radioactive wastes including spent steam generator blowdown and condensate polishing demineralizer resins. Higher activity spent resins such as chemical and volume control system and liquid waste management system demineralizer resins are not analyzed to be stored within the bunkers. Additional controls described in the Updated Final Safety Analysis Report (UFSAR) and LAR further limit the types and quantities of material that can be stored in the Radwaste Building and bunkers.

As a result, the NRC staff conducted a regulatory audit to review the calculations regarding hydrogen gas generation rates and concentrations within the bunkers to ensure that the hydrogen concentrations within the bunkers remain less than the specified concentration limit of 4 percent (which is the flammability limit for hydrogen), with one year of storage of the assumed waste forms and quantities.

### B. Bases

This regulatory audit is based on the following:

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criteria (GDC) 3 requires that SSCs important to safety shall be designed and located to minimize the probability and effects of fires and explosions.

10 CFR Part 50, Appendix A, GDC 61, requires, in part, that systems that may contain radioactivity be designed to assure adequate safety under normal and postulated accident conditions and shall be designed with appropriate containment, confinement, and filtering systems.

Regulatory Guide (RG) 1.189, "Fire Protection for Nuclear Power Plants," indicates that the design should minimize fires and explosions, including those that could be associated with the release of radioactive material and exposure to workers. RG 1.189

also indicates that the fire hazard analysis should include explosion-prevention measures in areas subject to potentially explosive environments from flammable gases or other potentially energetic sources, include ion exchange columns.

The audit plan is available in ADAMS under Accession Number ML16305A426.

C. Audit Location and Dates

Location: The audit was conducted at Westinghouse Electric Company's (the vendor's) local office:

Westinghouse Electric Company, LLC  
11333 Woodglen Drive, Suite 203  
Rockville, Maryland 20852

Date: November 14, 2016.

D. Audit Team Members

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

Paul Kallan, Project Manager  
Ed Stutzcage, Health Physicist  
Jimmy Chang, Engineer

E. Applicant and Industry Staff Participants

Paul Kallan	NRC
Edward Stutzcage	NRC
Jimmy Chang	NRC
Mory Diane	SCANA
Steven Leighty	Westinghouse Electric Company, LLC
Joseph Baron	Westinghouse Electric Company, LLC

F. Documents Included in the Audit

- Technical Report APP-5000-N4C-001 "AP1000-Analysis of Design Basis H2 Concentrations in the Radwaste Building Bunker Due to Storage of Spent Secondary Side Resins,"

G. Description of Audit Activities and Summary of Observations

As part of the audit, the applicant provided an overview of their approach for calculating the hydrogen concentrations within the bunkers. In addition, the applicant provided the staff with Technical Report APP-5000-N4C-001, which provides the calculation of hydrogen gas concentration within the Radwaste Building bunkers. The staff did not verify the applicant's calculations but instead reviewed information in the calculation package to perform their own confirmatory analysis to calculate the maximum hydrogen concentration inside of the bunkers.

The staff reviewed the maximum heat load inside the bunkers, as provided in the calculations and used that information as well as information provided in the LAR, to perform confirmatory calculations, to verify that the hydrogen concentrations in the bunkers would be less than

4 volume percent. Specifically, the staff used the G value of 1.7 molecules per 100 eV, specified in the LAR and consistent with the guidance of NUREG/CR-6673, "Hydrogen Generation in TRU Waste Transportation Packages," for resins, the specified volume of 423 cubic feet specified in the LAR, the calculated maximum storage time of 1-year specified in the LAR, the maximum heat load calculated in Technical Report APP-5000-N4C-001, along with other information, to perform a confirmatory calculation. The staff's confirmatory calculations showed that the maximum hydrogen concentration inside the bunkers would be less than 4 volume percent.

The proposed updates to the UFSAR, provided in the LAR, specify that the hydrogen concentrations will be less than 4 volume percent inside the bunkers and the types of resins that will be stored in the bunkers. It also specifies the types of resins that will be stored in the bunkers, as well as that the volumes, activity, and storage times will not exceed those specified in the calculations and provides other limitations for what can be stored inside the bunkers. Therefore, for the materials that will be included in the bunkers with the maximum one year storage time, as specified in the response and proposed UFSAR updates, the staff has reasonable assurance that the hydrogen concentration will remain below 4 volume percent inside the bunkers, which is acceptable.

#### H. Exit Briefing

The NRC staff's audit was conducted on the afternoon of November 15, 2016. The staff informed the applicant that they should formally submit the draft Revision 1, Supplement 2 to LAR 13-09, with the changes agreed to during a previous meeting. If the changes are as expected, the LAR will be acceptable.

#### I. Requests for Additional Information (RAI) 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

There were no deviations from the audit plan.

#### L. References

1. Request for License Amendment and Exemption 13-09, "Annex and Radwaste Building Changes," letter from Virgil C. Summer Nuclear Station, dated February 27, 2014 (ADAMS Accession Number ML14065A022), as revised and supplemented.

2. Regulatory Guide 1.189, "Fire Protection for Nuclear Power Plants"
3. NUREG/CR-6673, "Hydrogen Generation in TRU Waste Transportation Packages"
4. Technical Report APP-5000-N4C-001 "AP1000-Analysis of Design Basis H2 Concentrations in the Radwaste Building Bunker Due to Storage of Spent Secondary Side Resins"