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

November 3, 2017

MEMORANDUM TO: Troy W. Pruett, Director
Division of Reactor Projects
Region IV

FROM: Eric J. Benner, Deputy Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: RESPONSE TO TASK INTERFACE AGREEMENT 2014-07, COLUMBIA GENERATING STATION DESIGN AND LICENSING BASIS FOR CONTAINMENT NITROGEN INERTING SYSTEM AND EMERGENCY DIESEL GENERATOR FRESH AIR INTAKES

By memorandum dated November 10, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14316A633), the U.S. Nuclear Regulatory Commission Region IV office requested assistance from the Office of Nuclear Reactor Regulation (NRR) to clarify the Columbia Generating Station (CGS) licensing and design basis for the containment nitrogen inerting system cryogenic storage tank and its location near the emergency diesel generator fresh air intakes.

Region IV requested assistance answering the following questions:

1. Does the current design of the Columbia Generating Station emergency diesel generator fresh air intakes in relation to containment nitrogen inerting system conform to all applicable regulatory requirements including [Title 10 of the *Code of Federal Regulations* (10 CFR)] 50.63, "Loss of all alternating current power," and 10 CFR Part 50, Appendix A, Criterion 2, "Design Bases for Protection Against Natural Phenomena?"

2. Were the conclusions in "Supplemental Safety Evaluation (SSE) of the Washington Public Power Supply System Nuclear Project No. 2 (WNP-2) Station Blackout Analysis (TAC M68626)," dated June 26, 1992, based on the probability of a tornado missile impact with nitrogen tank CN-TK-1 or on the understanding that the nitrogen plume would be dispersed by winds following a tornado?

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The NRR staff finds that CGS, as licensed, conforms to the regulatory requirements of 10 CFR 50.63. The basis for this position can be found in Section 3.0 of the Enclosure.

Enclosure:
Response to Task Interface
Agreement 2014-07

RESPONSE TO TASK INTERFACE AGREEMENT 2014-07

DESIGN AND LICENSING BASIS FOR CONTAINMENT NITROGEN INERTING SYSTEM AND EMERGENCY DIESEL GENERATOR FRESH AIR INTAKES

ENERGY NORTHWEST

COLUMBIA GENERATING STATION

DOCKET NO. 50-397

1.0 INTRODUCTION

By memorandum dated November 10, 2014 (Reference 1), the U.S. Nuclear Regulatory Commission (NRC) Region IV office requested assistance from the Office of Nuclear Reactor Regulation (NRR) to clarify the Columbia Generating Station (CGS) licensing and design basis for the containment nitrogen inerting (CN) system cryogenic storage tank and its location near the emergency diesel generator (EDG) fresh air intakes.

Region IV requested assistance answering the following questions:

1. Does the current design of the Columbia Generating Station emergency diesel generator fresh air intakes in relation to containment nitrogen inerting system conform to all applicable regulatory requirements including 10 CFR [Title 10 of the *Code of Federal Regulations*] 50.63, "Loss of all alternating current power," and 10 CFR Part 50, Appendix A, Criterion 2, "Design Bases for Protection Against Natural Phenomena?"

2. Were the conclusions in "Supplemental Safety Evaluation (SSE) of the Washington Public Power Supply System Nuclear Project No. 2 (WNP-2) Station Blackout Analysis (TAC M68626)," dated June 26, 1992, based on the probability of a tornado missile impact with nitrogen tank CN-TK-1 or on the understanding that the nitrogen plume would be dispersed by winds following a tornado?

2.0 BACKGROUND

2.1 Regulatory Evaluation

The regulation under 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," establishes minimum requirements for nuclear power plants. General Design Criterion (GDC) 2, "Design bases for protection against natural phenomena," requires, in part, that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena without loss of capability to perform their safety function.

The regulation under 10 CFR 50.63, "Loss of all alternating current power," requires, in part, that a nuclear power plant be able to withstand a station blackout (SBO) for a specified duration and be able to recover from that SBO. The capability to cope with an SBO for the specified duration must be demonstrated in a coping analysis unless an alternate alternating current (AC) power source is shown to be available to power the shutdown buses within 10 minutes of the SBO onset.

Regulatory Guide (RG) 1.155, "Station Blackout," August 1988 (Reference 2), describes a method acceptable to the staff for compliance with the requirements of 10 CFR 50.63. This RG also endorses guidance contained in NUMARC-87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," November 1987 (Reference 3), for meeting the requirements of 10 CFR 50.63 and provides additional clarification on specific topics where RG 1.155 take precedence.

2.2 System Descriptions

The standby AC power source for CGS consists of three EDGs serving three divisions of emergency power. The EDGs are housed in three separate rooms adjacent to each other within the diesel generator building. The air intakes for the EDGs are located along the same external wall for each diesel generator room.

The CN system is designed to establish and maintain a nitrogen atmosphere in both the drywell and the wetwell air space during normal operation. The CN system also supplies nitrogen to the containment instrument air system. Storage for the nitrogen supply is in the CN system cryogenic storage tank, CN-TK-1. CN-TK-1 is located outside the diesel generator building at the exterior corner near the EDG air intakes. CN-TK-1 is not housed in any protective structure but is shielded by the structure of the diesel generator building on two sides.

2.3 Original Identification of the Potential for CN-TK-1 Failure

On February 10, 1989, the licensee notified the NRC of previously unanalyzed failure modes in the CGS CN system. This issue was described in Licensee Event Report LER-89-001-00 (Reference 4), and was determined to have the potential to impact safety-related equipment required to achieve safe shutdown of the reactor. LER-89-001-00 described four potential failure modes for CN-TK-1. Failure Mode 3 identified the potential for failure of CN-TK-1 due to a tornado missile impact:

> Failure Mode 3 – A tornado missile that causes failure of the exposed CN-TK-1 and associated piping outside the buildings that results in the release of large quantities of liquid nitrogen which might starve the emergency diesel generators of oxygen.

The licensee determined that the safety significance of failure mode 3 was minimal:

> Failure Mode 3 – A tornado which produces a missile sufficient to topple and/or rupture the CN Liquid Nitrogen Storage Tank and associated piping would include enough wind to provide mixing and dilution to the point that the emergency diesel generators would not be starved for oxygen. The ability of the reactor to achieve safe shutdown is not compromised in this failure mode.

The final update to this LER was made November 14, 1991, in LER 89-001-02 (Reference 5). The resolution of failure mode 3, a tornado missile capable of toppling or rupturing the tank, was not revised and further corrective actions were not identified. The LER did not include or reference any calculation in support of the assertion that a tornado would produce sufficient mixing and dilution to prevent the diesel generators from being starved of oxygen.

A dispersion analysis was performed for the most limiting non-mechanistic break in the CN system piping (failure mode 4) and found that the EDGs could be starved for up to eight minutes. This failure mode was determined to not be safety significant because the break itself could not lead to a loss of off-site power, and the EDGs were not relied on in this situation.

2.4 Station Blackout Rule

On April 17, 1989 (Reference 6), the licensee provided an evaluation of CGS against the requirements of 10 CFR 50.63 using the guidance of NUMARC 87-00 and RG 1.155. This letter identified that the Division 3 EDG would be utilized as the alternate AC power source. The potential tornado missile impact on CN-TK-1 was considered from the perspective of whether the Division 3 EDG could be claimed as an alternate AC power source. The licensee stated that the probability of a tornado missile impact was low, and that even should such an impact occur the wind accompanying the tornado would aid in the dispersal of the nitrogen plume. The NRC eventually determined that the Division 3 EDG could not be classified as an alternate AC power source for reasons unrelated to any tornado missile impact on the EDG availability. In the NRC staff's SE (Reference 8), the staff concluded that the classification of the Division 3 EDG as an alternate AC power source was irrelevant because the licensee had provided a coping analysis using an 'AC independent' approach.

In response to an open item in the SE, the licensee described modifications that were made to the CN system. This letter referenced LER-89-001-02 and the completion of modifications made to address failure modes 1 and 2. However, for the purpose of satisfying the requirements of the SBO rule, no modifications to the CN system were required. Following receipt of this response, the NRC issued a supplemental SE dated June 26, 1992 (Reference 10), stating that CGS had satisfied the requirements of 10 CFR 50.63.

2.5 Recent Identification of Potential CN-TK-1 Failure

In August of 2013, NRC inspection staff questioned the technical basis for the Final Safety Analysis Report (FSAR) Section 3.3.2.4 statement that "due to turbulent mixing produced in close proximity to a tornado, no oxygen deficiency condition could be sustained outdoors at the diesel generator intake structures." This statement appears to originate from the discussion found in LER-89-001-00 with respect to failure mode 3. The NRC inspectors found that the licensee failed to verify or check by calculation the adequacy of the technical basis that justified the dispersion of nitrogen in a tornado event. Due to the failure of CGS to verify or check the adequacy of the design , the NRC cited CGS with a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," in Inspection Report (IR) 05000397/2013007 (Reference 11).

Subsequent to preparing TIA-2014-07, the NRC inspection staff was provided a new analysis of a postulated rupture of CN-TK-1 by a tornado missile.

3.0. REGULATORY EVALUATION

The NRR staff performed a review of documentation associated with the SBO licensing of CGS, particularly those documents referenced in the NRC SE and the supplemental SE. These documents were reviewed in an effort to determine the basis of the regulatory decision expressed in the supplemental SE with respect to the CN system and CN-TK-1.

3.1 TIA Question 1

Does the current design of the CGS EDG fresh air intakes in relation to containment nitrogen inerting system conform to all applicable regulatory requirements including 10 CFR 50.63, "Loss of all alternating current power," and 10 CFR Part 50, Appendix A, Criterion 2, "Design Bases for Protection Against Natural Phenomena?"

Response to Question 1:

The potential for a tornado missile to rupture or topple CN-TK-1 was identified prior to the licensee's submittal evaluating the facility against the requirements of 10 CFR 50.63. The tornado missile impact was considered and addressed by the NRC during its review of the 10 CFR 50.63 submittal. The NRC staff found the licensee's submittal, as supplemented, to be acceptable, as documented in the SE and supplemental SE. Therefore, with respect to the CN system design, CGS conforms to the requirements of 10 CFR 50.63.

LER-89-001-00 and subsequent revisions maintained that a tornado which produces a missile sufficient to topple or rupture CN-TK-1 would include enough wind to provide mixing and dilution to the point that the EDGs would not be starved. The NRC staff reviewed this potential failure mode in the LER and in the review of the licensee's SBO evaluation. The NRC staff found no issues with the licensee's determination that no modifications were necessary to address this failure mode. Therefore, the design of the CN system was determined to be acceptable and incorporated into the current licensing basis discussion of protection from natural hazards (GDC 2).

3.2 TIA Question 2

Were the conclusions in "Supplemental Safety Evaluation of the Washington Public Power Supply System Nuclear Project No. 2 (WNP-2) Station Blackout Analysis (TAC M68626)," dated June 26, 1992, based on the probability of a tornado missile impact with nitrogen tank CN-TK-1 or on the understanding that the nitrogen plume would be dispersed by winds following a tornado?

Response to Question 2:

The conclusions in the supplemental SE, specifically meeting the requirements of 10 CFR 50.63 without the need for design changes in the CN system, were based on the probability of a tornado missile impact. The licensee's classification of the Division 3 EDG as an alternate AC required that no single point vulnerability exist where a likely weather-related event could disable the onsite emergency AC power sources and simultaneously fail the alternate AC source. The licensee concluded that the probability of a tornado was very low and it was not a 'likely weather-related event". Therefore, modifications to the CN system were not necessary.

4.0 CONCLUSION

Based on its review, the NRR staff finds that the design of the CN system is in compliance with the current licensing basis. Any records supporting the assumption that winds accompanying a tornado would be sufficient to disperse the nitrogen plume should be maintained in accordance with applicable requirements.

5.0 POTENTIAL OUTCOMES

- Immediate Implications: Upon receiving the conclusions of this TIA, the licensee is expected to have an analysis of record available to support the assumption that winds following the postulated external event are sufficient to disperse any nitrogen plume. There are no immediate safety concerns.

- Generic Implications: This plant-specific issue does not warrant the issuance of a generic communication.

- Backfit Considerations: Resolution of this issue does not constitute a backfit because it does not involve a new or different position from a previously applicable staff position.

6.0 REFERENCES

1. U.S. Nuclear Regulatory Commission, internal memorandum, Troy W. Pruett to Aby S. Mohseni, "Request for Technical Assistance - Columbia Generating Station Design and Licensing Basis of Containment Nitrogen Inerting System and Emergency Diesel Generator Fresh Air Intakes (TIA 2014-007)," dated November 10, 2014 (ADAMS Accession No. ML14316A633).

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.155, "Station Blackout," August 1988 (ADAMS Accession No. ML003740034).

3. Nuclear Management and Resources Council, Inc., NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," November 1987 (ADAMS Accession No. ML102710587).

4. Washington Public Power Supply System to U.S. Nuclear Regulatory Commission "Licensee Event Report, LER 89-001-00, 'Unanalyzed Failed Modes Discovered for Containment Nitrogen System,'" dated February 10, 1989 (ADAMS Legacy Accession No. 8902170416).

5. Baker, J. W., Washington Public Power Supply System, letter to U.S. Nuclear Regulatory Commission, Amendment to Licensee Event Report, LER 89-001-02, "Unanalyzed Failed Modes Discovered for Containment Nitrogen System Caused By Inadequate Design Procedures," dated November 14, 1991 (ADAMS Accession No. ML14350A146).

6. Sorensen, G. C., Washington Public Power Supply System, letter to U.S. Nuclear Regulatory Commission, GO2-89-062, "Response to Station Blackout Rule Using HPCS Division III as Alternate AC Power," dated April 17, 1989 (ADAMS Accession No. ML14350A141).

7. Sorensen, G. C., Washington Public Power Supply System, letter to U.S. Nuclear Regulatory Commission, GO2-91-128, "Additional Information Regarding Station Blackout (TAC 68626)," dated July 1, 1991 (ADAMS Accession No. ML14350A145).

8. Eng, P. L., U.S. Nuclear Regulatory Commission, letter to G. C. Sorensen, Washington Public Power Supply System, "Safety Evaluation of the Washington Public Power Supply System Nuclear Project Number 2 Station Blackout Analysis," dated December 30, 1991 (ADAMS Legacy Accession No. ML17076A099).

9. Sorensen, G. C., Washington Public Power Supply System, letter to U.S. Nuclear Regulatory Commission Letter, GO-92-057, "Safety Evaluation of the Washington Public Power Supply System Nuclear Project Number 2 Station Blackout Analysis," dated March 6, 1992 (ADAMS Accession No. ML14350A147).

10. Assa, R. R., U.S. Nuclear Regulatory Ciommission, letter to G. C. Sorensen, Washington Public Power Supply System, "Supplemental Safety Evaluation (SSE) of the Washington Public Power Supply System Nuclear Project No. 2 (WNP-2) Station Blackout Analysis (TAC M68626)," dated June 26, 1992 (ADAMS Accession No. ML14357A315).

11. Farnholtz, T. R., U.S. Nuclear Regulatory Commission, letter to Mark E. Reddeman, Energy Northwest, "Inspection Report, IR 05000397/2013007, 'Columbia Generating Station - The NRC Component Design Bases Inspection Report,'" dated October 2, 2013 (ADAMS Accession No. ML13275A213).

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Date: November 3, 2017

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