UNITED STATES
NUCLEAR REGULATORY COMMISSION
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October 17, 2018

MEMORANDUM TO: Tony Vegel, Director
Division of Reactor Projects
Region IV

FROM: Kathryn M. Brock, Deputy Director Kathryn M. Brock
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: RESPONSE TO TASK INTERFACE AGREEMENT 2014–08, ASSESSMENT OF THE DESIGN AND LICENSING BASES OF THE TOWER MAKEUP SYSTEM AT COLUMBIA GENERATING STATION (CAC NO. MF4630; EPID L-2014-LRA-0002)

By memorandum dated November 10, 2014, the U.S. Nuclear Regulatory Commission (NRC) Region IV, Division of Reactor Projects, requested assistance from the NRC Office of Nuclear Reactor Regulation (NRR) to conduct a technical assessment of the Columbia Generating Station (CGS) design and licensing bases for the tower makeup (TMU) system. This issue had been identified during a routine baseline inspection and was characterized as an unresolved item in the NRC's Integrated Inspection Report 05000397/2014002.

The NRR staff has reviewed the matter and has concluded that the TMU system is not part of the ultimate heat sink complex and that the requirement of Technical Specification 3.7.1, "Standby Service Water (SW) System and Ultimate Heat Sink (UHS)," is not applicable to the TMU system. The NRR staff has also concluded that the TMU system piping and components were not designated as Safety Class components and are not subject to the quality assurance requirements pursuant to Appendix B to Part 50 of Title 10 of the *Code of Federal Regulations*. The basis for these conclusions can be found in Section 3.0 of the enclosure. The conclusions represent the NRR staff's position based on information specific to CGS and are not generic and do not directly apply to other licensees or sites.

Enclosure:
Response to Task Interface
Agreement 2014-08

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RESPONSE TO TASK INTERFACE AGREEMENT 2014-08

ASSESSMENT OF THE DESIGN AND LICENSING BASES

FOR THE TOWER MAKEUP SYSTEM

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, Division of Reactor Projects, requested assistance from the NRC Office of Nuclear Reactor Regulation (NRR) to conduct a technical assessment of the Columbia Generating Station (CGS) design and licensing bases for the tower makeup (TMU) system. This issue had been identified during a routine baseline inspection and was characterized as an unresolved item in NRC Integrated Inspection Report 05000397/2014002, dated May 7, 2014 (Reference 2).

To focus the effort, the Region IV staff requested assistance answering two questions:

1. Is the Columbia Generating Station TMU system considered part of the UHS [ultimate heat sink] or considered a support system for the UHS and should the operation requirement of Technical Specification 3.7.1 apply to the system?

2. Should the Columbia Generating Station TMU system be considered a safety-related system and should the quality assurance requirements of [Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50], Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants" apply to the system?

2.0 BACKGROUND

2.1 Applicable NRC Regulations and Guidance and Plant-Specific Design and Licensing Basis Information

The regulation at 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," establishes minimum requirements for the principal design criteria for water-cooled nuclear power plants.

The regulation at 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1, "Quality standards and records," states, in part, that, "[s]tructures, systems, and components [SSCs] important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed."

The regulation at 10 CFR Part 50, Appendix A, GDC 2, "Design bases for protection against natural phenomena," requires, in part, that SSCs important to safety be designed to withstand the effects of natural phenomena without loss of capability to perform their safety functions.

The regulation at 10 CFR Part 50, Appendix A, GDC 44, "Cooling water," states:

> A system to transfer heat from [SSCs] important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these [SSCs] under normal operating and accident conditions.
>
> Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

Regulatory Guide (RG) 1.27, Revision 2, "Ultimate Heat Sink for Nuclear Power Plants," January 1976 (Reference 3), describes an acceptable design basis that may be used to implement GDCs 2 and 44 with respect to the UHS. As stated in Chapter 1 of the current CGS Final Safety Analysis Report (FSAR), Amendment 64 (Reference 4), CGS complies with the guidance set forth in this regulatory guide with one clarification:

> The clarification is that the tower makeup system (TMU) water supply is only an ultimate heat sink feature in the event of a design basis tornado. Since Regulatory Guide 1.27 states that we need not consider two or more most severe natural phenomena occurring simultaneously, the TMU was designed to be tornado proof but was not designed and constructed to withstand the effects of the operating basis earthquake (OBE) and water flow based on severe historical events in the region.

The NRR staff reviewed the historical statement of compliance with RG 1.27. At the time that the operating license was issued, Appendix C of the CGS FSAR, Amendment 33, stated that CGS complied with the intent of RG 1.27, Revision 2, by an alternate approach and this statement of compliance has been carried forward to the current CGS FSAR in Chapter 9, Section 9.2, "Water Systems" (Reference 5), and in Chapter 3, Table 3.2-1, "Equipment Classification" (Reference 6). Specifically, the current CGS FSAR provides that, since the basic design and much of the construction of the spray ponds was completed prior to the issuance of RG 1.27, Revision 2, the thermal and mass loss analyses were based on RG 1.27, Revision 1, using a 30-day period with the worst dew point depression and average winds during that period. For conservatism in the thermal analysis, the worst day of the 30-day period was assumed to repeat until the spray pond temperature peaked (3 days repetition). For conservatism in the mass loss analysis, five times the drift loss for the highest daily average wind speed during the 30-day period was assumed to occur for the entire 30-day period.

The current CGS FSAR also provides that two Seismic Category I spray ponds are used at CGS, each with a capacity of 6.5 million gallons. The makeup for these ponds is supplied from the pumphouse at the Columbia River. The makeup water piping is buried under a minimum of 5 feet of Quality Class I fill. The makeup water supply system is utilized only in the event of a design basis tornado missile impact that renders the two redundant spray pond spray trees

inoperable and, therefore, it is not designed and constructed to withstand the effects of the OBE and water flow based on severe historical events in the region.

Regulatory Guide 1.26, Revision 3, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," February 1976 (Reference 7), describes a quality classification system that may be used to determine quality standards acceptable for satisfying GDC 1 for safety-related components. CGS complies with the guidance set forth in this regulatory guide, as stated in Chapter 1 of FSAR Amendment 64:

> The definition of quality group classifications for CGS was provided in the [Preliminary Safety Analysis Report (PSAR)] in accordance with [American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME B&PV)] Code, Sections III and VIII. Quality group classifications have been maintained during design and construction. Quality group classifications are maintained during plant operations and modifications by plant administrative procedures and the plant modification control process. The quality group classifications are commensurate with the safety functions performed by the safety-related components.

2.2 System Descriptions

The UHS at CGS consists of two concrete spray ponds that serve as a water source for the safety-related standby service water (SW) system. Section 1.2.2.12.3, "Ultimate Heat Sink," of the current CGS FSAR states:

> Two spray ponds that serve as the UHS conservatively have a combined equivalent storage of 30 days, assuming no makeup and maximum evaporation and drift losses. Provisions are made to replenish the sink to allow continued cooling capability beyond the initial 30-day period.

The UHS is further described in Section 9.2.5, "Ultimate Heat Sink," of the current CGS FSAR. It can perform its safety function without makeup except in the event of a tornado missile impact that renders the two redundant spray trees inoperable.

The SW system performs the safety-related function of transferring heat from SSCs important to safety. The SW system is designed to remove heat from plant systems required for safe shutdown following a loss-of-coolant accident, referred to in the current CGS FSAR as the emergency mode of operation, and designed to remove decay heat from the residual heat removal system during normal plant shutdown. In the emergency mode of operation, the SW system draws water from the spray ponds and discharges back to the spray ponds via two redundant annuli of spray trees, one over each spray pond, where heat is rejected by evaporation. Ultimate heat sink water temperature is a design input to the SW system and the spray trees are required to maintain the UHS temperature within the design basis limits. The spray ponds and spray trees are a part of the SW system, as stated in Section 2.4.8, "Cooling Water Canals and Reservoirs," and Section 9.2.7, "Standby Service Water System," of the current CGS FSAR.

The spray trees are not protected from tornado missiles and may be rendered inoperable in the event of a design-basis tornado. If both spray trees are lost, the UHS is designed with a continuous makeup operating mode that is protected from the effects of tornadoes and tornado

missiles. In the continuous makeup UHS operating mode, water from the Columbia River is continuously fed to the service water spray ponds by the TMU system to ensure that the water inventory and UHS temperature remains within the design limits.

During normal operation, the TMU system, which is classified as non-safety-related, provides makeup to the circulating water system to replace water lost from the cooling towers by evaporation, drift, and blowdown. The TMU consists of three pumps housed in the makeup water pumphouse structure. The system is provided with two divisions of emergency alternating current power and the TMU system piping and components are fully protected from tornado missiles. The TMU system and makeup water pumphouse are both Seismic Category II as defined in the current CGS FSAR.

2.3 Region IV Staff Position

The Region IV staff position on the TMU system is set forth in the task interface agreement (TIA) dated November 10, 2014, and is summarized below.

During a baseline inspection, Region IV inspectors identified several conflicting statements between the initial and current licensing basis with regard to the safety classification of the TMU system. The original licensing basis described TMU as an integral element of the UHS whereas the current licensing basis only describes the TMU system as a non-safety-related system.

The Region IV staff questions the discrepancies within the licensing basis of the TMU as it is described in the CGS FSAR at the time the operating license was approved and the facility's Safety Evaluation Report (SER) contained in NUREG-0892, "Safety Evaluation Report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System," March 1982 (Reference 8). In these cases, the TMU is described as both "safety-related" and "non-safety-related." The Region IV staff position is that these discrepancies are due to the dual nature (normal operation and tornado mitigation) of the TMU's function.

2.4 Licensee Position

By letter dated March 6, 2015 (Reference 9), Energy Northwest responded to the Region IV staff position regarding Unresolved Item 05000397/2014002 in response to the TIA. The licensee performed a review of the TMU system with regard to the licensing basis and support documentation. The licensee asserted that the TMU system meets all applicable regulatory requirements. The licensee stated, in part, that "[a]lthough the TMU system may be classified by Energy Northwest as not safety related, it has been treated as 'important to safety.' This is reflected in the system design, operation and maintenance." As such, the licensee stated that there is no impact on the health and safety of the public. The licensee responded to the Region IV staff's first question as follows:

> It is Energy Northwest's position that the TMU system is a support system for the UHS and only necessary to support UHS operability in the event of a tornado.

The licensee responded to the Region IV staff's second question as follows:

> It is Energy Northwest's position that the TMU system was always classified as non-safety related and only certain support structures (e.g., TMU pumphouse, soil covering the piping to the UHS, etc.) were loosely characterized as safety related.

3.0 EVALUATION

The NRR staff performed a review of the documents referenced in both the TIA request and the licensee's response dated March 6, 2015. In addition, the NRR staff performed a search for docketed licensing correspondence that may have contained information relative to the TIA request. The SER for the operating license application (NUREG-0892; Reference 8) was reviewed in addition to all supplements to the SER. The NRR staff also reviewed the information in the CGS FSAR at the time the operating license was issued (Amendment 33) and the information in the current CGS FSAR (Amendment 64) in preparing this response.

3.1 TIA Question No. 1

Is the Columbia Generating Station TMU system considered part of the UHS or considered a support system for the UHS and should the operation requirement of Technical Specification 3.7.1 apply to the system?

Response to TIA Question No. 1

The TMU system is not identified as part of the UHS in the current CGS FSAR. FSAR Section 9.2.5.2 states, in part, that "[t]he UHS consists of two concrete ponds. The concrete ponds provide suction and discharge points for the redundant pumping and spray facilities of the SW system." The TMU provides a source of makeup to the UHS, and this makeup is necessary to meet the UHS design basis in the event that both spray trees are lost due to tornado missiles. While the TMU performs this function in support of the UHS, this does not mean that the TMU is part of the UHS. As such, the requirement of Technical Specification (TS) 3.7.1, "Standby Service Water (SW) System and Ultimate Heat Sink (UHS)," does not apply to the TMU system.

The guidance of RG 1.27, Revision 2, states that the UHS should be capable of providing sufficient cooling for at least 30 days, and that the UHS should be capable of withstanding the most severe natural phenomena. This regulatory guide also states that a cooling capacity of less than 30 days may be acceptable if it can be demonstrated that replenishment can be effected to assure the continuous capability of the UHS to perform its safety function. Following the postulated loss of the two spray trees due to tornado missile impact, the UHS at CGS cannot provide sufficient cooling for 30 days in the normal mode of operation. In this scenario, the TMU system was licensed to provide replenishment and assure the continuous capability of the UHS to perform its safety function. The TMU system was provided with protection from tornado missiles, a safety-related source of power, and suitable redundancy to demonstrate that the system was able to perform this function in the event of a tornado that causes the failure of the two redundant spray trees. This alternate approach was described in the FSAR and approved by the NRC staff.

The NRR staff reviewed the content of CGS FSAR Amendment 33 for historical perspective from the time of original licensing. CGS FSAR Amendment 33 did not identify the TMU system as part of the UHS in tables or in system descriptions. The exception to this was

Section 3.3.2.3, "Effect of Failure of Structures or Components Not Designed for Tornado Loads," which contains a description of the strategy for coping with the loss of the spray trees. That section states, "The makeup water system and the standby service water system, including the spray ponds, act as the ultimate heat sink." This statement is made in describing the response after the spray trees have been lost and the UHS is no longer able perform its safety function without replenishment. While the TMU system is necessary to accomplish the safety function of the UHS in this scenario, the NRR staff concluded that the licensing basis did not support treatment of the TMU system as a part of the UHS.

While TS 3.7.1 does not apply to the TMU system, the capability of this system should be a consideration in the operability of the UHS. The UHS design basis for protection from tornado missile impacts that render the two redundant spray trees inoperable, as described in the CGS FSAR, is to operate with continuous makeup to the spray ponds via the TMU system. This is captured in the licensing basis for conformance with GDC 2. The NRC issued Regulatory Information Summary (RIS) 2013-05, "NRC Position on the Relationship between General Design Criteria and Technical Specification Operability," dated May 9, 2013 (Reference 10), to clarify the relationship of the GDC and the TS. The RIS 2013-05 states, in part, that:

> It is the staff's position that failure to meet GDC, as described in the licensing basis (e.g., nonconformance with the CLB [current licensing basis] for protection against flooding, seismic events, tornadoes) should be treated as a nonconforming condition and is an entry point for an operability determination if the nonconforming condition calls into question the ability of SSCs to perform their specified safety function(s) or necessary and related support function(s).

In the case of CGS, the licensing basis is that the UHS meets GDC 2 because, in part, the TMU system is able to perform its support function for the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable. The failure of the TMU system to be able to perform its support function for the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable should be treated as a nonconforming condition and is an entry point for a UHS operability determination. If the UHS is determined to be inoperable in this manner, CGS would enter Condition D of Limiting Condition for Operation 3.7.1, "UHS inoperable for reasons other than [sediment depth]."

3.2 TIA Question No. 2

Should the Columbia Generating Station TMU system be considered a safety-related system and should the quality assurance requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," apply to the system?

Response to TIA Question No. 2

No. The CGS TMU system is a non-safety-related system and the requirements of 10 CFR Part 50, Appendix B, do not apply to it. The classification of the TMU system is captured in Table 3.2-1 of the current CGS FSAR. The entry for the TMU system shows that all components of this system are Safety Class G, Quality Group Classification D, Quality Class II, and Seismic Category II. These classifications indicate that the TMU system components are non-safety-related and not subject to the quality assurance requirements of 10 CFR Part 50, Appendix B. The classification of the TMU system in the current CGS FSAR is consistent with the original classification of the system, which was reviewed and approved by the NRC staff in the facility SER.

There are discrepancies in the language of the historical CGS FSAR sections when describing the TMU system as non-safety-related or safety-related. The source of these discrepancies appears to the be the dual purpose of the TMU system as the normal source of makeup water for the non-safety-related circulating water system and as the credited source of makeup water for the safety-related UHS following a tornado missile impact that renders the two redundant spray trees inoperable. For example, Section 3.5.2 of Amendment 33 to the FSAR describes the tornado protection for SSCs required to bring the plant to safe shutdown. In this section, the TMU is referred to as safety-related, but the additional clarification is made that the TMU system is only required for safe shutdown following a tornado missile impact that renders the two redundant spray trees inoperable. This section states, in part, that:

> The standby service water (SSW) and the tower makeup water (TMU) pipelines and electrical lines between the SSW pumphouses, the TMU pumphouse, the reactor building, and the diesel generator building are located below grade and are protected from external missiles by sufficient Quality Class 1 earth cover of high relative density (described in 3.5.3). The SSW and the TMU piping systems are the only safety-related water piping systems outside of tornado protected buildings. The TMU system is required for safe shutdown only when both spray ring headers are lost to tornado missiles (see 3.3.2).

While this section makes a reference to the TMU system as safety-related, there are other sections in Amendment 33 to the CGS FSAR that explicitly describe the system as non-safety-related, in addition to FSAR Table 3.2-1. Section 2.4.10 states, in part, that "[t]he flooding of the makeup water pumphouse [where the TMU system components are housed] would not affect safety-related equipment and would not affect the safe shutdown of the plant." Section 3.8.4.1.6 states, in part, that "[t]he cooling tower makeup system piping, pumps, and valves are classified as Quality Group D as defined in Regulatory Guide 1.26, Rev. 3, and in Table 3.2-1." There were no cases that stated that the TMU system and components were designed to standards other than Safety Class G, Quality Group Classification D, Quality Class II, and Seismic Category II.

While the TMU system is not safety-related, it was designed with additional protection and capabilities to ensure availability following a postulated tornado missile impact that renders the two redundant spray trees inoperable. The TMU system piping and components are fully protected from tornado missiles by structures and earthworks constructed in accordance with the quality assurance requirements of 10 CFR Part 50, Appendix B. The TMU system is provided with two divisions of emergency alternating current power, also fully protected from tornado missiles. Further, the TMU system has sufficient redundancy of active components to perform its function following a single active failure. For facilities that utilize spray ponds as the water source for the UHS, the use of a non-safety-related system to provide makeup water following a design-basis tornado event is consistent with NRC staff practice at the time. Similar configurations appear in the licensing basis for the Susquehanna Steam Electric Station and the Limerick Generating Station.

In conclusion, the NRC staff finds that the TMU system, as licensed, is not classified as safety-related and is not subject to the quality assurance requirements of 10 CFR Part 50, Appendix B.

4.0 CONCLUSION

Based on a review of the applicable NRC regulations and guidance and plant-specific design and licensing basis information, the NRR staff concludes that:

1. The CGS TMU system is not considered a part of the UHS and the requirement of TS 3.7.1 is not applicable to the TMU system. However, the CGS licensing basis provides that the UHS meets GDC 2 because, in part, the TMU system is able to perform its support function for the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable. Therefore, the failure of the TMU system to be able to perform its support function for the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable should be treated as a nonconforming condition and is an entry point for a UHS operability determination.

2. The CGS TMU system is a non-safety-related system and the requirements of 10 CFR Part 50, Appendix B, do not apply to it. The piping, pumps, and valves of the TMU system were classified as non-safety-related in the original licensing of the plant, and this classification was accepted by the NRC staff at the time. While it is not a safety-related system, the TMU system has been provided with additional protection and capability to ensure that it is readily available to provide makeup to the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable.

5.0 POTENTIAL OUTCOME PATHS

Immediate Implications: Because the NRR staff concluded that the CGS licensing basis does not require that the TMU system be classified as safety-related, no licensee action is necessary with respect to this issue. Because the NRR staff concluded that the CGS licensing basis provides that the TMU system is able to perform its support function for the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable, the failure of the TMU system to be able to perform its support function for the UHS in the event of a tornado missile impact that renders the two redundant spray trees inoperable should be treated as a nonconforming condition and is an entry point for a UHS operability determination. If the UHS is determined to be inoperable in this manner, CGS would enter Condition D of Limiting Condition for Operation 3.7.1, "UHS inoperable for reasons other than [sediment depth]."

Generic Implications: Resolution of this issue does not warrant the issuance of a generic communication, as the issue is specific to CGS.

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 NRC staff position.

6.0 REFERENCES

1. Pruett, T. W., memorandum to Aby S. Mohseni, U.S. Nuclear Regulatory Commission, "Request for Technical Assistance – Columbia Generating Station Design and Licensing Basis of Tower Makeup System (TIA 2014-008)," dated November 10, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14316A634; Not publicly available – sensitive internal information).

2. Taylor, N. H., U.S. Nuclear Regulatory Commission, letter to Mark E. Reddemann, Energy Northwest, "Columbia Generating Station – NRC Integrated Inspection Report 05000397/2014002," dated May 7, 2004 (ADAMS Accession No. ML14127A419).

3. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.27, Revision 2, "Ultimate Heat Sink for Nuclear Power Plants," January 1976 (ADAMS Accession No. ML003739969).

4. Hettel, W. G., Energy Northwest, letter to U.S. Nuclear Regulatory Commission, "Columbia Generating Station, Docket No. 50-397, 10 CFR 50.71 Maintenance of Records Licensing Basis Document Update and Biennial Commitment Change Report," FSAR Amendment 64, dated December 21, 2017 (ADAMS Package Accession No. ML17355A655).

5. CGS FSAR, Amendment 64, Chapter 9, dated December 21, 2017 (ADAMS Accession No. ML17355A667).

6. CGS FSAR, Amendment 64, Chapter 3, dated December 21, 2017 (ADAMS Accession No. ML17355A662).

7. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.26, Revision 3, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," February 1976 (ADAMS Accession No. ML003739964).

8. U.S. Nuclear Regulatory Commission, NUREG-0892, "Safety Evaluation Report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System," March 1982 (ADAMS Accession No. ML12034A129).

9. Gregoire, D. W., Energy Northwest, letter to U.S. Nuclear Regulatory Commission, "Columbia Generating Station, Docket No. 50-397; TIA XXXX-XX, Tower Makeup System Unresolved Issue," dated March 6, 2015 (ADAMS Accession No. ML15083A094).

10. U.S. Nuclear Regulatory Commission, Regulatory Issue Summary 2013-05, "NRC Position on the Relationship between General Design Criteria and Technical Specification Operability," dated May 9, 2013 (ADAMS Accession No. ML13056A077).

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Evan J. Davidson

Date: October 17, 2018

SUBJECT: RESPONSE TO TASK INTERFACE AGREEMENT 2014–08, ASSESSMENT OF THE DESIGN AND LICENSING BASES FOR THE TOWER MAKEUP SYSTEM AT COLUMBIA GENERATING STATION (CAC NO. MF4630; EPID L-2014-LRA-0002) DATED OCTOBER 17, 2018

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