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

May 18, 2011

Mr. Mark E. Reddemann
Chief Executive Officer
Energy Northwest
P.O. Box 968 (Mail Drop 1023)
Richland, WA 99352-0968

SUBJECT: COLUMBIA GENERATING STATION - ISSUANCE OF AMENDMENT RE: INCREASED BORON CONCENTRATION IN STANDBY LIQUID CONTROL SYSTEM (TAC NO. ME4789)

Dear Mr. Reddemann:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 221 to Facility Operating License No. NPF-21 for the Columbia Generating Station (CGS). The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated September 30, 2010.

The amendment revises TS 3.1.7, "Standby Liquid Control (SLC) System," to support a transition to GE14 fuel in the CGS reactor core. Specifically, the changes raise the required average boron concentration in the SLC delivered to the reactor core from 660 parts per million (ppm) natural boron to a concentration equivalent to 780 ppm natural boron. The licensee will accomplish this by using sodium pentaborate solution enriched with the Boron-10 (B-10) isotope. As a result, the amendment adds a new TS Surveillance Requirement 3.1.7.9 to verify sodium pentaborate enrichment is $\geq$ 44.0 atom percent B-10 prior to addition to the SLC tank. The associated TS Bases will be updated under TS 5.5.10, "Technical Specification (TS) Bases Control Program," to reflect the increase in the SLC B-10 enrichment.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosures:
1. Amendment No. 221 to NPF-21
2. Safety Evaluation

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

ENERGY NORTHWEST

DOCKET NO. 50-397

COLUMBIA GENERATING STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 221
License No. NPF-21

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Energy Northwest (licensee), dated September 30, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-21 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 221 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented during the spring 2011 refueling outage.

FOR THE NUCLEAR REGULATORY COMMISSION

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Facility
Operating License No. NPF-21
and Technical Specifications

Date of Issuance: May 18, 2011

ATTACHMENT TO LICENSE AMENDMENT NO. 221

FACILITY OPERATING LICENSE NO. NPF-21

DOCKET NO. 50-397

Replace the following pages of the Facility Operating License No. NPF-21 and Appendix A, Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Facility Operating License

REMOVE	INSERT
-3-	-3-

Technical Specification

REMOVE	INSERT
3.1.7.3	3.1.7.3

(3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source of special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

(6) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to store byproduct, source and special nuclear materials not intended for use at Columbia Generating Station. The materials shall be no more than 9 sealed neutron radiation sources designed for insertion into pressurized water reactors and no more than 40 sealed beta radiation sources designed for use in area radiation monitors. The total inventory shall not exceed 24 microcuries of strontium-90, 20 microcuries of uranium-235, 30 curies of plutonium-238, and 3 curies of americium-241.

C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The licensee is authorized to operate the facility at reactor core power levels not in excess of full power (3486 megawatts thermal). Items in Attachment 1 shall be completed as specified. Attachment 1 is hereby incorporated into this license.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 221 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

(a) For Surveillance Requirements (SRs) not previously performed by existing SRs or other plant tests, the requirement will be considered met on the implementation date and the next required test will be at the interval specified in the Technical Specifications as revised in Amendment No. 149.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.7.5	Verify each SLC subsystem manual and power operated valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position or can be aligned to the correct position.	31 days
SR 3.1.7.6	Verify each pump develops a flow rate $\geq$ 41.2 gpm at a discharge pressure $\geq$ 1220 psig.	In accordance with the Inservice Testing Program
SR 3.1.7.7	Verify flow through one SLC subsystem from pump into reactor pressure vessel.	24 months on a STAGGERED TEST BASIS
SR 3.1.7.8	Verify all heat traced piping between storage tank and pump suction valve is unblocked.	24 months AND Once within 24 hours after solution temperature is restored within the limits of Figure 3.1.7-1
SR 3.1.7.9	Verify sodium pentaborate enrichment is $\geq$ 44.0 atom percent B-10.	Prior to addition to SLC Tank

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 221 TO

FACILITY OPERATING LICENSE NO. NPF-21

ENERGY NORTHWEST

COLUMBIA GENERATING STATION

DOCKET NO. 50-397

1.0 INTRODUCTION

By letter dated September 30, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102861222), Energy Northwest (the licensee), submitted a license amendment request (LAR) to the U.S. Nuclear Regulatory Commission (NRC) for revision to the Technical Specifications (TSs) for Columbia Generating Station (CGS).

The amendment would revise TS 3.1.7, "Standby Liquid Control (SLC) System," to support a transition to GE14 fuel in the CGS reactor core. Specifically, the changes would raise the required average boron concentration in the SLC delivered to the reactor core from 660 parts per million (ppm) natural boron to a concentration equivalent to 780 ppm natural boron. The licensee will accomplish this by using sodium pentaborate solution enriched with the Boron-10 (B-10) isotope. As a result, the amendment would add a new TS Surveillance Requirement (SR) 3.1.7.9 to verify sodium pentaborate enrichment is $\geq$ 44.0 atom percent B-10 prior to addition to the SLC tank. The associated TS Bases will be updated under TS 5.5.10, "Technical Specification (TS) Bases Control Program," to reflect the increase in the SLC B-10 enrichment.

2.0 REGULATORY EVALUATION

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The TSs ensure the operational capability of structures, systems, and components that are required to protect the health and safety of the public. The NRC's regulatory requirements related to the content of the TSs are contained in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications." That regulation requires that the TSs include items in the following specific categories: (1) safety limits, limiting safety systems settings, and limiting control settings; (2) limiting conditions for operation (LCOs); (3) SRs; (4) design features; and (5) administrative controls. However, the regulation does not specify the particular TS to be included in a plant's license.

The regulations in 10 CFR 50.36(c)(3) state that,

> Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met

The NRC's guidance for the format and content of licensee's TSs is contained in NUREG-1434, "Standard Technical Specifications, General Electric Plants, BWR/6," Revision 3.0 (ADAMS Accession No. ML041910204).

The SLC system is an independent reactivity control system that provides shutdown capability under normal and anticipated transient without scram conditions which are requirements of paragraph (c)(4) of 10 CFR Section 50.62, "Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants." The shutdown capability requirements of the SLC system during normal operation is specified in 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 26, "Reactivity control system redundancy and capability," which states that,

> Two independent reactivity control systems of different design principles shall be provided. One of the systems shall use control rods, preferably including a positive means for inserting the rods, and shall be capable of reliably controlling reactivity changes to assure that under conditions of normal operation, including anticipated operational occurrences, and with appropriate margin for malfunctions such as stuck rods, specified acceptable fuel design limits are not exceeded. The second reactivity control system shall be capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure acceptable fuel design limits are not exceeded. One of the systems shall be capable of holding the reactor core subcritical under cold conditions.

The control rods are required to provide the normal method for reactivity control. They are capable of maintaining the reactor subcritical in presence of a stuck rod, and without the need for addition of any soluble neutron absorber (i.e., boron) to the reactor coolant. The SLC system acts as a backup to the insertion of control rods to provide a diverse means of making the reactor subcritical. To comply with GDC 26, the SLC system must have an adequate amount of neutron absorber in solution, and the capability to inject at a rate sufficient to bring the reactor from rated power to cold shutdown, at any time in core life, with the control rods remaining withdrawn in the rated power pattern. The SLC system must also take into account the reactivity gains from complete decay of the rated power xenon inventory, an allowance for imperfect mixing and leakage, and dilution by the residual heat removal system. As fuel bundle enrichment and core reactivity increase to meet the cycle energy requirements, the SLC system shutdown boron concentration must increase to continue satisfying the reactivity control requirements of GDC 26. The licensee must calculate a cycle-specific SLC shutdown concentration for each cycle's core design to confirm that the SLC system boron concentration will satisfy the cold shutdown capability requirements.

3.0 TECHNICAL EVALUATION

3.1 Proposed TS Changes

In its letter dated September 30, 2010, the licensee proposed changing TS 3.1.7, "Standby Liquid Control (SLC) System," by adding new SR 3.1.7.9 as follows:

	SURVEILLANCE	FREQUENCY
SR 3.1.7.9	Verify sodium pentaborate enrichment is ≥44.0 atom percent B-10.	Prior to addition to SLC Tank

The associated TS Bases will be updated under TS 5.5.10, "Technical Specification (TS) Bases Control Program," to reflect the increase in the SLC B-10 enrichment.

3.2 NRC Staff Evaluation

The NRC staff has reviewed the licensee's request for addition of new SR 3.1.7.9 to the TSs, and evaluated the post-loss-of-coolant accident (LOCA) safety consequences of the effect of any changes in the suppression pool pH due to the addition of greater than or equal to 44.0 atom percent concentration of B-10 to SLC.

3.2.1 Revision to TS 3.1.7, "Standby Liquid Control (SLC) System"

The licensee has determined that it is necessary to increase the SLC system boron concentration from 660 ppm of natural boron to a concentration equivalent to 780 ppm natural boron in order to meet the SLC shutdown objectives during the next cycle (Cycle 21) of operation with GE14 fuel. The licensee employed Global Nuclear Fuels (GNF) to determine the new concentration. GNF used NRC-approved methods described in General Electric Standard Application for Reactor Fuel (GESTAR II).

The licensee proposed to add TS SR 3.1.7.9, which verifies the sodium pentaborate solution B-10 enrichment is greater than or equal to 44 atom percent B-10. A sodium pentaborate solution enrichment of 22 atom percent B-10 was calculated to achieve an equivalent concentration of 780 ppm natural boron in the reactor. The licensee proposes to add this new SR to support future improvements, such as operation in the Maximum Extended Load Line Limit Analysis (MELLLA) domain. This will allow the licensee to change out the requisite SLC tank contents this one time, and use greater than or equal to 44 atom percent of B-10 (rather than current 22 atom percent). This will provide additional conservatism until future improvements are implemented. This proposed change is consistent with NUREG-1434, Revision 3.

Natural boron contains 19.8 atom percent of the B-10 isotope. B-10, with its large neutron absorption capability, is the active component in sodium pentaborate solution. In order to achieve the increased neutron absorber concentration equivalent to 780 ppm natural boron, the licensee will use sodium pentaborate solution enriched with the B-10 isotope, which is chemically and physically similar to the current solution. The use of sodium pentaborate enriched with the B-10 isotope provides a faster negative reactivity insertion rate than the same quantity of sodium pentaborate with natural boron. The existing SLC system design requires injection of a quantity of boron that includes an additional 25 percent above that needed for an in-vessel boron concentration of 660 ppm, to allow for imperfect mixing and leakage. As part of this proposed change, an additional 25 percent above that needed for an in-vessel boron concentration equivalent to 780 ppm natural boron will also be injected. Operation within the Acceptable Operation region of TS Figure 3.1.7-1, with a sodium pentaborate enrichment of greater than or equal to 44 atom percent B-10 in accordance with new SR 3.1.7.9, will achieve or exceed the required concentration equivalent to 780 ppm natural boron in the reactor core. This change is consistent with the Bases for TS 3.1.7 contained in NUREG-1434, Revision 3.

3.2.2 Effect of Changes to pH in the Suppression Pool

Addition of the B-10 affects the pH of the coolant system. After a LOCA, a variety of different chemical species are released from the damaged core. One of them is radioactive iodine. This iodine, when released to the outside environment, will significantly contribute to radiation doses. It is, therefore, essential to keep it confined within the plant's containment. According to NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," February 1995 (ADAMS Accession No. ML041040063), iodine is released from the core in three different chemical forms; at least 95 percent is released in ionic form as cesium iodide (CsI) and the remaining 5 percent as elemental iodine (I_2) and hydriodic acid (HI). The iodine release contains at least one percent each of I_2 and HI.

CsI and HI are ionized in water and are, therefore, soluble. However, elemental iodine has low solubility. To sequester the iodine in water, it is desirable to maintain as much as possible of the released iodine in ionic form. In radiation environments existing in containment, some of the ionic iodine dissolved in water is converted into elemental form. The degree of conversion varies significantly with the pH of water. At a higher pH, conversion to elemental form is lower and at pH greater than 7, it becomes negligibly small. The relationship between the rate of conversion and pH is specified in Figure 3.1 of NUREG/CR-5950, "Iodine Evolution and pH Control," December 1992 (ADAMS Accession No. ML063460464).

Based on its review, the NRC staff concludes that there would not be any significant impact on the existing pH. The NRC staff's calculations used the alternative source term analysis assumptions for calculation source term. The assumptions are appropriate and consistent with the methods accepted by the NRC staff for the calculation of post-accident containment suppression pool pH calculation. Based on the above, the NRC staff concludes that the changes in suppression pool pH will not be significant to the post-accident consequences of postulated accidents.

The NRC staff concludes that the proposed boron enrichment greater than or equal to 44 atom percent in the SLC is acceptable, because it provides adequate margin to ensure that reactor loaded with GE14 fuel will be rendered cold shutdown, when required. The margin of boron concentration will be adequate. The impact of the B-10 addition on pH will not be significant and will not have a significant effect on the calculated post-LOCA evolution of elemental iodine from the suppression pool. Accordingly, the NRC staff concludes that the proposed revisions meet the requirements of 10 CFR 50.36 and are, therefore, acceptable.

3.3 Regulatory Commitment

In its letter dated September 30, 2010, the licensee made the following regulatory commitment:

> Raise the Standby Liquid Control tank boron enrichment level to be in compliance with the revised analysis requirements

The licensee's regulatory commitment, to be performed prior to startup from refuel 20 (currently planned for spring of 2011), relates to raising the SLC tank boron enrichment level to be consistent with the licensee's calculated requirement. The NRC staff concludes that the proposed commitment is consistent with the revision to TS 3.1.7, and is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Washington State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding published in the *Federal Register* on December 14, 2010 (75 FR 77912). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: M. Razzaque
J. Gall
K. Bucholtz
M. Yoder

Date: May 18, 2011

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosures:
1. Amendment No. 221 to NPF-21
2. Safety Evaluation

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