Dominion Energy Kewaunee, Inc.
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Dominion

January 18, 2008

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No. 07-0403A
NL&OS/CS: R3
Docket No. 50-305
License No. DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING KEWAUNEE LICENSE AMENDMENT REQUEST 228

By letter dated September 24, 2007 (reference 1), Dominion Energy Kewaunee, Inc. (DEK) requested an amendment to facility operating license number DPR-43 for Kewaunee Power Station (KPS). The proposed amendment would add a reference to Dominion Topical Report DOM-NAF-5, "Application of Dominion Nuclear Core Design and Safety Analysis Methods to the Kewaunee Power Station (KPS)," to the KPS Technical Specification (TS) list of approved analytical methods. The license amendment request also proposed specific TS changes designed to appropriately accommodate use of the methodologies in DOM-NAF-5.

On November 1, 2007, a telephone conference was held between members of the NRC staff and DEK to discuss two questions associated with this license amendment request. At the end of the discussion, DEK agreed to submit a written response to each question. Attachment 1 contains a summary of each question and the associated DEK response. Attachment 2 contains a revised version of a marked-up TS page and revised version of several TS bases pages, originally submitted in reference 1, which have been affected by the DEK response to one of the questions. Please note that the changes proposed to KPS TS page TS 2.1-1 in our original license amendment request (reference 1) have been withdrawn and the TS page TS 2.1-1, included in Attachment 2, is identical to the current KPS TS page TS 2.1-1. The net effect is that no change is proposed to KPS TS page TS 2.1-1.

The proposed change to the originally submitted TS page does not affect the conclusion of the significant hazards consideration as provided in reference 1. A copy of this submittal has been provided to the State of Wisconsin in accordance with 10 CFR 50.91(b).

If you have any questions or require additional information, please contact Mr. Craig D. Sly at 804-273-2784.

Very truly yours,

Gerald T. Bischof
Vice President – Nuclear Engineering

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Gerald T. Bischof, who is Vice President, Nuclear Engineering of Dominion Energy Kewaunee, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 18th day of January, 2008.

My Commission Expires: August 31, 2008.

Margaret B. Bennett
Notary Public

MARGARET B. BENNETT
Notary Public 354302
Commonwealth of Virginia
My Commission Expires Aug 31, 2008

References:

1. Letter from G. T. Bischof (DEK) to NRC, "License Amendment Request 228, Incorporation of Dominion Nuclear Analysis and Fuel Topical Report DOM-NAF-5 into Kewaunee Technical Specifications," dated September 24, 2007.

Attachments:

1. NRC Questions and Dominion Energy Kewaunee Response
2. Revised Marked-up Technical Specification Page
3. Revised Marked-up Technical Specification Bases Pages

Commitments made in this letter: None

cc: Regional Administrator
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ATTACHMENT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING KEWAUNEE LICENSE AMENDMENT REQUEST 228

NRC QUESTIONS AND DOMINION ENERGY KEWAUNEE RESPONSES

KEWAUNEE POWER STATION

DOMINION ENERGY KEWAUNEE, INC.

1.0 SUMMARY DESCRIPTION

By letter dated September 24, 2007 (reference 1), Dominion Energy Kewaunee, Inc. (DEK) requested an amendment to facility operating license number DPR-43 for Kewaunee Power Station (KPS). The proposed amendment would add a new analytical method, Dominion Topical Report DOM-NAF-5, "Application of Dominion Nuclear Core Design and Safety Analysis Methods to the Kewaunee Power Station (KPS)," to the KPS Technical Specification (TS) list of approved analytical methods used to determine core operating limits. The license amendment request also proposed specific TS changes designed to appropriately accommodate use of the methodologies in DOM-NAF-5.

On November 1, 2007, a telephone conference was held between members of the NRC staff and DEK to discuss two questions associated with this license amendment request. At the end of the discussion, DEK agreed to submit a written response to each question. A summary of each question and the associated DEK response is provided below.

NRC Question 1

The amendment request proposes a change to Kewaunee TS 2.1, "Safety Limits - Reactor Core," Specification b, which currently specifies the departure from nucleate boiling ratio (DNBR) be maintained above certain specific limits, to require DNBR be maintained greater than the 95/95 DNBR criterion developed with the methodologies in TS 6.9.a.4, "Core Operating Limits Report," (i.e. DOM-NAF-5). It is the NRC staff position that this proposed change would relocate specific DNBR limits to the COLR and replace them with a criterion (e.g. not a specific safety limit) contrary to the requirements of 10 CFR 50.36 (c) (1).

DEK Response

Dominion Energy Kewaunee proposes to revise the amendment request to implement the NRC staff position above. Therefore, DEK requests TS 2.1.b not be changed. Specifically, the amendment requested a change to TS 2.1, "Safety Limits - Reactor Core," Specification b as follows.

TS 2.1.b currently states the following:

> *"The departure from nucleate boiling ratio (DNBR) shall be maintained ≥ <u>1.14 for the HTP DNB correlation and 1.17 for the WRB-1 DNB correlation</u>."*

The license amendment request proposed a revision to TS 2.1.b as follows:

> *"The departure from nucleate boiling ratio (DNBR) shall be maintained ≥ <u>the 95/95 DNBR criterion for the DNB correlations and methodologies specified in Section 6.9</u>."*

The original wording in TS 2.1.b remains appropriate, since this license amendment request does not involve a change to the fuel designs currently licensed for use at Kewaunee, or the Departure from Nucleate Boiling (DNB) correlations used for thermal-hydraulic analyses that have already been approved for use by the NRC. For the Westinghouse 422 V+ fuel design, the applicable DNB correlation is the WRB-1 correlation, as cited in References 2 and 3. For the Seimens High Thermal Performance (HTP) fuel design, the applicable DNB correlation is the HTP correlation, as cited in Reference 4.

Therefore, Dominion Energy Kewaunee proposes that the requested change to incorporate the 95/95 DNBR criterion into TS 2.1.b be withdrawn and the original wording of this TS be retained without any changes.

NRC Question 2

The amendment request proposes a change to TS 3.10.b, "Power Distribution Limits," to reference a more generic nomenclature for height-dependent hot channel factor in place of the current Westinghouse method-specific nomenclature. The NRC staff requested an explanation as to why the use of different nomenclatures for height-dependent hot channel factors would not create confusion between Westinghouse and Dominion control methods.

DEK Response

The license amendment request proposed changes to KPS TS 3.10.b, "Power Distribution Limits," to revise the nomenclature for the height dependent hot channel factor F_Q^{EQ} (Z) to a more generic nomenclature F_Q^N (Z) for this core surveillance parameter. The more generic nomenclature F_Q^N (Z) in the TSs would allow application of either Westinghouse (Relaxed Axial Offset Control, RAOC) or Dominion (Relaxed Power Distribution Control, RPDC) power distribution control and analysis methods to the KPS core.

F_Q^N (Z), Height Dependent Nuclear Flux Hot Channel Factor, is defined as the maximum local linear power density in the core at core elevation Z divided by the core average linear power density, assuming nominal fuel rod dimensions. An upper bound envelope (limit) for F_Q^N (Z) as specified in the COLR has been determined from analyses considering all OPERATING maneuvers consistent with the TSs on power distribution control. The core flux map surveillance of core power distribution is taken under equilibrium conditions to determine F_Q^N (Z). This measured F_Q^N (Z) is increased by appropriate uncertainties to account for manufacturing tolerances and measurement uncertainty. The measured F_Q^N (Z) is also increased by appropriate factors to account for non-equilibrium operation.

The current Kewaunee Power Station (KPS) TSs refer to an F_Q^N (Z) equilibrium relationship and an F_Q^{EQ} (Z) transient relationship. F_Q^{EQ} (Z) is the measured F_Q^N (Z) obtained at equilibrium conditions during the core flux map. Because the value of F_Q^N (Z) represents an equilibrium condition, it does not include the variations of F_Q^N (Z) that are present during non-equilibrium situations such as control rod movement and power level changes. To account for these possible variations, the equilibrium value of F_Q^N (Z) is adjusted by an elevation dependent factor that accounts for the calculated transient conditions. The elevation dependent function represents the maximum likely increase in the equilibrium measured F_Q^N (Z) that might arise during power distribution transients in non-equilibrium operation. F_Q^N (Z) surveillance is accomplished by comparing the product of the measured F_Q^N (Z) and the analytically determined transient factor to the F_Q^N (Z) limit.

The proposed KPS TS change maintains the distinction in the current TS 3.10.b between equilibrium and transient F_Q^N (Z) without encumbering the description with vendor-specific nomenclature.

The proposed change allows application of either Westinghouse RAOC or Dominion RPDC power distribution control and analysis methods to the KPS core. Both power distribution control methods (RPDC and RAOC) are methods for axial power distribution control. The power distribution control methods involve a variable axial flux difference (delta-I) band power distribution control strategy that uses a widened full power delta-I band, and provides for an increasing delta-I band with decreasing power. The widened delta-I band is based on maintaining an approximately constant analysis margin to the design bases limits at all power levels. The relaxed power distribution control benefits plant operation by increasing plant operating flexibility (e.g. the ability to return to power after a trip, particularly at end-of-cycle (EOC), is enhanced). Control rod motion necessary to compensate for delta-I band restrictions is reduced to only that motion needed to maintain operation within a much wider band. The reactor coolant system boration and dilution requirements are decreased due, in part, to the reduced control rod motion.

The RAOC and RPDC power distribution control methods involve the formulation of TS surveillance and COLR limits for Total Peaking Factor, F_Q^N (Z). The F_Q^N (Z) surveillance uses the measured core axial position-dependent F_Q^N (Z) augmented by a non-equilibrium operation multiplier (W(Z) for Westinghouse RAOC methods and N(Z) for Dominion RPDC methods) in order to verify compliance with the peaking factor limits. This FQ surveillance is a required element of both the RAOC and RPDC relaxed power distribution methods.

The proposed revised nomenclature for the height dependent hot channel factor F_Q^{EQ} (Z) to a more generic nomenclature F_Q^N (Z) would allow application of either Westinghouse RAOC or Dominion RPDC power distribution control and analysis methods to the KPS core. The F_Q^N (Z) surveillance limits and the specific power distribution control methods that are required for a given operating cycle will depend on the power distribution control strategy and method used for that cycle. The F_Q^N (Z) surveillance limits and the power distribution control methods applicable to that cycle will be documented in the cycle specific COLR and will contain the methodology specific nomenclature.

Thus, the proposed change to a more generic nomenclature in the TSs will allow application of either the Westinghouse RAOC or the Dominion RPDC power distribution control method to the KPS core. This will not create confusion between the two methods when they are applied during cycle operation. The cycle specific COLR will document the actual power distribution control method and the F_Q^N (Z) surveillance limits that must be applied during operation.

2.0 <u>References</u>

1. Letter from G. T. Bischof (DEK) to NRC, "License Amendment Request 228, Incorporation of Dominion Nuclear Analysis and Fuel Topical Report DOM-NAF-5 into Kewaunee Technical Specifications," dated September 24, 2007.

2. Letter from P. D. Milano (NRC) to D. A. Christian (DEK), Kewaunee Power Station – Safety Evaluation for Topical Report DOM-NAF-5 (TAC No. MD2829)," dated August 30, 2007.

3. Letter from J. G. Lamb (NRC) to T. Coutu (NMC), Kewaunee Nuclear Power Plant – Issuance of Amendment (TAC No. MB5718)," dated April 3, 2003.

4. Letter from J. G. Lamb (NRC) to M. Reddemann (NMC), Kewaunee Nuclear Power Plant – Review for Kewaunee Reload Safety Evaluation Methods Topical Report WPSRSEM-NP, Revision 3 (TAC No. MB0306)," dated September 10, 2001.

ATTACHMENT 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING KEWAUNEE LICENSE AMENDMENT REQUEST 228

REVISED MARKED-UP TECHNICAL SPECIFICATION PAGE

Page

TS 2.1-1

Note

The changes proposed to KPS TS page TS 2.1-1 in the original License Amendment Request 228 have been withdrawn and the TS page TS 2.1-1 included in this Attachment is identical to the current KPS TS page TS 2.1-1. The net effect is that no change is proposed to KPS TS page TS 2.1-1.

KEWAUNEE POWER STATION

DOMINION ENERGY KEWAUNEE, INC.

2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 SAFETY LIMITS - REACTOR CORE

APPLICABILITY

Applies to the limiting combination of thermal power, Reactor Coolant System pressure and coolant temperature during the OPERATING and HOT STANDBY MODES.

OBJECTIVE

To maintain the integrity of the fuel cladding.

SPECIFICATION

a. The combination of RATED POWER level, coolant pressure, and coolant temperature shall not exceed the limits specified in the COLR. The SAFETY LIMIT is exceeded if the point defined by the combination of Reactor Coolant System average temperature and power level is at any time above the appropriate pressure line.

b. The departure from nucleate boiling ratio (DNBR) shall be maintained ≥ 1.14 for the HTP DNB correlation and 1.17 for the WRB-1 DNB correlation.

c. The peak fuel centerline temperature shall be maintained < 5080°F decreasing by 58°F per 10,000 MWD/MTU of burnup.

ATTACHMENT 3

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING
KEWAUNEE LICENSE AMENDMENT REQUEST 228

REVISED MARKED-UP TECHNICAL SPECIFICATION BASES PAGES

Pages:

TS B2.1-1
TS B2.1-2

KEWAUNEE POWER STATION

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BASIS - Safety Limits-Reactor Core (TS 2.1)

The reactor core safety limits shall not be exceeded during steady state operation, normal operational transients, and anticipated operational occurrences. This is accomplished by having a departure from nucleate boiling (DNB) design basis, which corresponds to a 95% probability at a 95% confidence level (the 95/95 DNBR criterion) that DNB will not occur and by requiring that fuel centerline temperature stays below the melting temperature.

The restrictions of the reactor core safety limits prevent overheating of the fuel and cladding as well as possible cladding perforation that would result in the release of fission products to the reactor coolant. Overheating of the fuel is prevented by maintaining the steady state peak linear heat rate (LHR) below the level at which fuel centerline melting occurs. Overheating of the fuel cladding is prevented by restricting fuel operation to within the nucleate boiling regime where the heat transfer coefficient is large and the cladding surface temperature is slightly above the coolant saturation temperature.

Fuel centerline melting occurs when the local LHR, or power peaking, in a region of the fuel is high enough to cause the fuel centerline temperature to reach the melting point of the fuel. Expansion of the pellet upon centerline melting may cause the pellet to stress the cladding to the point of failure, allowing an uncontrolled release of activity to the reactor coolant.

To maintain the integrity of the fuel cladding and prevent fission product release, it is necessary to prevent overheating of the cladding under all OPERATING conditions. This is accomplished by operating the hot regions of the core within the nucleate boiling regime of heat transfer, wherein the heat transfer coefficient is very large and the clad surface temperature is only a few degrees Fahrenheit above the coolant saturation temperature. The upper boundary of the nucleate boiling regime is termed departure from nucleate boiling (DNB) and at this point there is a sharp reduction of the heat transfer coefficient, which would result in high clad temperatures and the possibility of clad failure. DNB is not, however, an observable parameter during reactor operation. Therefore, the observable parameters of RATED POWER, reactor coolant temperature and pressure have been related to DNB through a DNB correlation. The DNB correlation has been developed to predict the DNB heat flux and the location of the DNB for axially uniform and non-uniform heat flux distributions. The local DNB ratio (DNBR), defined as the ratio of the heat flux that would cause DNB at a particular core location to the local heat flux, is indicative of the margin to DNB. The minimum value of the DNBR, during steady-state operation, normal operational transients, and Condition I and II transients is ~~limited to the DNBR limit. This minimum DNBR~~less than the 95/95 DNBR criterion. The 95/95 DNBR crtierion corresponds to a 95% probability at a 95% confidence level that DNB will not occur and is chosen as an appropriate margin to DNB for all OPERATING conditions.

The SAFETY LIMIT curves as provided in the Core Operating Report Limits Report show the loci of points of thermal power, reactor coolant system average temperature, and reactor coolant system pressure for which the minimum DNBR is not less than the safety analysis limit, that fuel centerline temperature remains below melting, that the average enthalpy at the exit of the core is less than or equal to the enthalpy of saturated liquid, or that the core exit quality is within limits defined by the DNBR correlation. At low pressures or high temperatures the average enthalpy at the exit of the core reaches saturation before the DNBR ratio reaches the DNBR limit and thus, this limit is conservative with respect to maintaining clad integrity. The area where clad integrity is ensured is below the safety limit curves.

The curves are based on the nuclear hot channel factor limits of as specified in the COLR.

These limiting hot channel factors are higher than those calculated at full power for the range from all control rods fully withdrawn to maximum allowable control rod insertion. The control rod insertion limits are given in TS 3.10.d. Slightly higher hot channel factors could occur at lower power levels because additional control rods are in the core. However, the control rod insertion limits as specified in the COLR ensure that the increase in peaking factor is more than offset by the decrease in power level.

The Reactor Control and PROTECTION SYSTEM is designed to prevent any anticipated combination of transient conditions that would result in a DNBR less than the DNBR limit95/95 DNBR criterion.

Two departure from nucleate boiling ratio (DNBR) correlations are used in the generation and validation of the safety limit curves: the WRB-1 DNBR correlation and the high thermal performance (HTP) DNBR correlation. The WRB-1 correlation applies to the Westinghouse 422 V+ fuel. The HTP correlation applies to FRA-ANP fuel with HTP spacers. The DNBR correlations have been qualified and approved for application to Kewaunee. The DNB correlation limits are 1.14 for the HTP DNBR correlation, and 1.17 for the WRB-1 DNBR correlation. The approved DNBR correlations and methodologies are documented in Section 6.9.