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

August 28, 2015

Mr. Adam C. Heflin  
President, Chief Executive Officer,  
and Chief Nuclear Officer  
Wolf Creek Nuclear Operating Corporation  
P.O. Box 411  
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION - ISSUANCE OF AMENDMENT RE:  
REVISE TECHNICAL SPECIFICATION 5.6.5, "CORE OPERATING LIMITS  
REPORT (COLR)," TO ADD ASTRUM TO THE LIST OF ANALYTICAL  
METHODS (TAC NO. MF3518)

Dear Mr. Heflin:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 213 to Renewed Facility Operating License No. NPF-42 for the Wolf Creek Generating Station. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated February 26, 2014, as supplemented by letters dated December 8, 2014, and January 21 and July 15, 2015.

The amendment revises TS 5.6.5, "CORE OPERATING LIMITS REPORT (COLR)," to incorporate Westinghouse Electric Company LLC's topical report WCAP-16009-P-A, "Realistic Large-Break LOCA [Loss-of-Coolant Accident] Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," January 2005, to the list of analytical methods used to determine the core operating limits.

Enclosure 2 to this letter contains Proprietary Information. When separated from Enclosure 2, this letter is DECONTROLLED.
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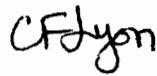
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A. Heflin

- 2 -

Additional information on the amendment changes and the NRC staff's safety evaluations are documented in Enclosure 2 (proprietary version) and Enclosure 3 (non-proprietary version). The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,



Carl F. Lyon, Project Manager  
Plant Licensing Branch IV-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosures:

1. Amendment No. 213 to NPF-42
2. Safety Evaluation (proprietary)
3. Safety Evaluation (non-proprietary)

cc w/encls 1 and 3: Distribution via Listserv

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**ENCLOSURE 1**

AMENDMENT NO. 213

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482



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

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 213  
License No. NPF-42

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment to the Wolf Creek Generating Station (the facility) Renewed Facility Operating License No. NPF-42 filed by the Wolf Creek Nuclear Operating Corporation (the Corporation), dated February 26, 2014, as supplemented by letters dated December 8, 2014, and January 21 and July 15, 2015, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, as amended, 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 license 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 Renewed Facility Operating License No. NPF-42 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. 213, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated in the license. The Corporation shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

The license is also amended by changes as indicated in the attachment to this license amendment and Paragraph 2.C.(16) of Renewed Facility Operating License No. NPF-42 is hereby amended to read as follows:

(16) Additional conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. 213, are hereby incorporated into this license. Wolf Creek Nuclear Operating Corporation shall operate the facility in Accordance with the Additional Conditions.

In addition, the license is amended by changes as indicated in the attachment to this license amendment and Appendix D, "Additional Conditions," to the Renewed Facility Operating License No. NPF-42 is hereby amended to add the following new license condition to read as follows:

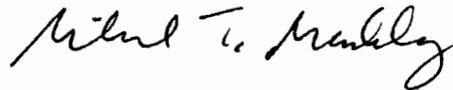
Automated Statistical Treatment of Uncertainty Method (ASTRUM), as corrected for thermal conductivity degradation (TCD) including the use of PAD 4.0 + TCD, has specifically been approved for use in the WCGS licensing basis analyses. Upon NRC approval of a revised generic best-estimate loss-of-coolant accident (LOCA) analysis methodology and fuel performance analysis methodology that accounts for TCD and is applicable to the fuel in use at WCGS, WCNOG will within 6 months, either:

- (a) Demonstrate that the WCGS safety analyses remain conservatively bounded in licensing basis analyses when compared to the new generically approved version of the LOCA analysis methodology and fuel performance analysis methodology that accounts for TCD, or
- (b) Provide a schedule for re-analysis of any of the affected licensing basis analyses using the new generically approved version of the

LOCA analysis methodology and fuel performance analysis methodology that accounts for TCD.

3. The license amendment is effective as of its date of issuance and shall be implemented within 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief  
Plant Licensing Branch IV-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Renewed Facility  
Operating License and  
Technical Specifications

Date of Issuance: August 28, 2015

ATTACHMENT TO LICENSE AMENDMENT NO. 213  
RENEWED FACILITY OPERATING LICENSE NO. NPF-42  
DOCKET NO. 50-482

Replace the following pages of the Renewed Facility Operating License No. NPF-42 and Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Renewed Facility Operating License

REMOVE

4  
7  
Appendix D, page 5

INSERT

4  
7  
Appendix D, page 5

Technical Specifications

REMOVE

5.0-26

INSERT

5.0-26

- (5) The Operating Corporation, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and
  - (6) The Operating Corporation, 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.
- C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations 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 Operating Corporation is authorized to operate the facility at reactor core power levels not in excess of 3565 megawatts thermal (100% power) in accordance with the conditions specified herein.
  - (2) Technical Specifications and Environmental Protection Plan  
  
The Technical Specifications contained in Appendix A, as revised through Amendment No. 213, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated in the license. The Corporation shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.
  - (3) Antitrust Conditions  
  
Kansas Gas & Electric Company and Kansas City Power & Light Company shall comply with the antitrust conditions delineated in Appendix C to this license.
  - (4) Environmental Qualification (Section 3.11, SSER #4, Section 3.11, SSER #5)\*

Deleted per Amendment No. 141.

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\*The parenthetical notation following the title of many license conditions denotes the section of the supporting Safety Evaluation Report and/or its supplements wherein the license condition is discussed.



(16) Additional conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. 213, are hereby incorporated into this license. Wolf Creek Nuclear Operating Corporation shall operate the facility in Accordance with the Additional Conditions.

- D. Exemptions from certain requirements of Appendix J to 10 CFR Part 50, and from a portion of the requirements of General Design Criterion 4 of Appendix A to 10 CFR Part 50, are described in the Safety Evaluation Report. These exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. Therefore, these exemptions are hereby granted pursuant to 10 CFR 50.12. With the granting of these exemptions the facility will operate, to the extent authorized herein, in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission.
- E. The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The set of combined plans, which contains Safeguards Information protected under 10 CFR 73.21, is entitled: "Wolf Creek Security Plan, Training and Qualification Plan, and Safeguard Contingency Plan," and was submitted on May 17, 2006.  
  
The licensee shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The licensee's CSP was approved by License Amendment No. 197, as supplemented by changes approved by License Amendment No. 202 and License Amendment No. 210.
- F. Deleted per Amendment No. 141.
- G. The licensees shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims.
- H. The Updated Safety Analysis Report (USAR) supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the USAR required by 10 CFR 50.71(e)(4), as appropriate, following the issuance of this renewed operating license. Until that update is complete, WCNOG may make changes to the programs and activities described in the supplement without prior Commission approval, provided that WCNOG evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

Amendment Number	Additional Condition	Implementation Date
179 (Cont'd)	<p data-bbox="484 369 1240 642">(b) The first performance of the periodic assessment of CRE habitability, Specification 5.5.18c.(ii), shall be within 3 years, plus the 9-month allowance of SR 3.0.2, as measured from August 16, 2004, the date of the most recent successful tracer gas test, as stated in the November 16, 2004, letter response to Generic Letter 2003-01, or within the next 9 months if the time period since the most recent successful tracer gas test is greater than 3 years.</p> <p data-bbox="484 674 1240 852">(c) The first performance of the periodic measurement of control room pressure, Specification 5.5.18.d, shall be within 18 months, plus the 138 days allowed by SR 3.0.2, as measured from February 2, 2007, the date of the most recent successful pressure measurement test.</p> <p data-bbox="484 884 1240 1157">Automated Statistical Treatment of Uncertainty Method (ASTRUM), as corrected for thermal conductivity degradation (TCD) including the use of PAD 4.0 + TCD, has specifically been approved for use in the WCGS licensing basis analyses. Upon NRC approval of a revised generic best-estimate loss-of-coolant accident (LOCA) analysis methodology and fuel performance analysis methodology that accounts for TCD and is applicable to the fuel in use at WCGS, WCNOC will within 6 months, either:</p> <p data-bbox="484 1188 1240 1367">(a) Demonstrate that the WCGS safety analyses remain conservatively bounded in licensing basis analyses when compared to the new generically approved version of the LOCA analysis methodology and fuel performance analysis methodology that accounts for TCD, or</p> <p data-bbox="484 1398 1240 1541">(b) Provide a schedule for re-analysis of any of the affected licensing basis analyses using the new generically approved version of the LOCA analysis methodology and fuel performance analysis methodology that accounts for TCD.</p>	Within 6 months of NRC approval of a revised methodology that accounts for TCD

5.6 Reporting Requirements

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5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

4. WCAP-10216-P-A, "Relaxation of Constant Axial Offset Control -  $F_Q$  Surveillance Technical Specification."
  5. WCNOC Topical Report NSAG-007, "Reload Safety Evaluation Methodology for the Wolf Creek Generating Station."
  6. NRC Safety Evaluation Report dated March 30, 1993, for the "Revision to Technical Specification for Cycle 7."
  7. WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)."
  8. WCAP-16045-P-A, "Qualification of the Two-Dimensional Transport Code PARAGON."
  9. WCAP-16045-P-A, Addendum 1-A, "Qualification of the NEXUS Nuclear Data Methodology."
  10. WCAP 10965-P-A, "ANC: A Westinghouse Advanced Nodal Computer Code."
  11. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report."
  12. WCAP-8745-P-A, "Design Bases for the Thermal Power  $\Delta T$  and Thermal Overtemperature  $\Delta T$  Trip Functions."
- c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.
- d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

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(continued)

**ENCLOSURE 3**

**(NON-PROPRIETARY)**

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 213 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-42

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482



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

**SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION**

**RELATED TO AMENDMENT NO. 213 TO**

**RENEWED FACILITY OPERATING LICENSE NO. NPF-42**

**WOLF CREEK NUCLEAR OPERATING CORPORATION**

**WOLF CREEK GENERATING STATION**

**DOCKET NO. 50-482**

**1.0 INTRODUCTION**

By application dated February 26, 2014, as supplemented by letters dated December 8, 2014, and January 21 and July 15, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML14064A328, ML14349A405, ML15029A198, and ML15202A123, respectively), Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) requested changes to the Technical Specifications (TSs) for Wolf Creek Generating Station (WCGS). Portions of the letters dated February 26, 2014, and January 21, 2015, contain sensitive unclassified non-safeguards information (proprietary) and, accordingly, have been withheld from public disclosure pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 2.390.

The supplemental letters dated December 8, 2014, and January 21 and July 15, 2015, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on September 9, 2014 (79 FR 53462).

The proposed changes would revise TS 5.6.5, "CORE OPERATING LIMITS REPORT (COLR)," to incorporate Westinghouse Electric Company LLC's topical report WCAP-16009-P-A, "Realistic Large-Break LOCA [Loss-Of-Coolant Accident] Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," January 2005,<sup>1</sup> to the list of analytical methods used to determine the core operating limits. Specifically, the proposed change replaces WCAP-10266-P-A, "The 1981 Version of the Westinghouse ECCS [emergency core cooling system] Evaluation Model Using the BASH Code," with the ASTRUM methodology in the list of approved analytical methods in TS 5.6.5.b.7 used to determine the core operating limits.

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<sup>1</sup> A non-proprietary version of the topical report, designated as WCAP-16009-NP-A, is available in ADAMS under Accession Nos. ML050910159 and ML050910161.

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## 2.0 REGULATORY EVALUATION

The NRC staff considered the following regulatory requirements and guidance in its review of the proposed license amendment request (LAR).

Section 50.36, "Technical specifications," of 10 CFR establishes the regulatory requirements related to the content of TSs. Pursuant to 10 CFR 50.36, TS are required to include items in the following specific categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings, (2) limiting conditions for operation, (3) surveillance requirements, (4) design features, (5) administrative controls, (6) decommissioning, (7) initial notification, and (8) written reports.

The regulations in 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," require that each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical zircaloy or ZIRLO cladding must be provided with an emergency core cooling system (ECCS) that must be designed so that its calculated cooling performance following postulated loss-of coolant accidents (LOCAs) conforms to the criteria set forth in 10 CFR 50.46(b), including peak cladding temperature (PCT), maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long-term cooling.

The NRC staff also based its review upon the following General Design Criteria (GDC) of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50:

- GDC 27, "Combined reactivity control systems capability," requires that the reactivity control systems be designed to have a combined capability, in conjunction with poison addition by the ECCS, of reliably controlling reactivity changes under postulated accident conditions and with appropriate margin for stuck rods, to assure the capability to cool the core is maintained.
- GDC 35, "Emergency core cooling," requires that a system to provide abundant emergency core cooling be provided...to transfer heat from the reactor core following any loss of reactor coolant at a rate such that fuel and clad damage that could interfere with continued effective core cooling is prevented.

## 3.0 TECHNICAL EVALUATION

### 3.1 Proposed Changes

The licensee has proposed to revise TS 5.6.5, "CORE OPERATING LIMITS REPORT (COLR)," to incorporate Westinghouse's topical report WCAP-16009-P-A, to the list of analytical methods used to determine the core operating limits for WCGS.

Specifically, the licensee has requested to delete current TS 5.6.5b.7, which states:

WCAP-10266-P-A, "The 1981 Version of the Westinghouse ECCS Evaluation Model Using the BASH Code."

and replace it with new TS 5.6.5b.7, which states:

WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using Automated Statistical Treatment of Uncertainty Method (ASTRUM)."

### 3.2 Background

Westinghouse obtained generic NRC approval of its original topical report describing the best-estimate (BE) large break loss-of-coolant accident (LBLOCA) methodology in 1996 for three- and four-loop pressurized-water reactors (PWRs). This method is known as the Code Qualification Document (CQD) methodology.<sup>2</sup> NRC approval of the methodology is documented in the NRC safety evaluation report dated June 28, 1996, appended to the topical report.

Westinghouse completed a program to revise the statistical approach used to develop the PCT and oxidation results at the 95th percentile. This method is based on the CQD methodology and follows the steps in the Code Scaling Applicability and Uncertainty (CSAU) methodology NUREG/CR-5249, Revision 4, "Quantifying Reactor Safety Margins: Application of Code Scaling, Applicability, and Uncertainty Evaluation Methodology to a Large-Break, Loss-of-Coolant Accident," December 1989 (ADAMS Accession Nos. ML030380473 and ML030380495; publically available with the exception of Appendix R, which contains Westinghouse proprietary data used to generate the code results). However, the uncertainty analysis (Element 3 in CSAU) is replaced by a technique based on order statistics. The Automated Statistical Treatment of Uncertainty Method (ASTRUM) methodology replaces the response surface technique with a statistical sampling method in which the uncertainty parameters are simultaneously sampled for each case. The approved ASTRUM evaluation model is documented in WCAP-16009-P-A.

On December 13, 2011, the NRC issued Information Notice (IN) 2011-21, "Realistic Emergency Core Cooling System Evaluation Model Effects Resulting from Nuclear Fuel Thermal Conductivity" (ADAMS Accession No. ML113430785). This IN discussed potential effects in realistic ECCS evaluation models of an error associated with the degradation of thermal conductivity in nuclear fuel. This error caused fuel temperature initial conditions to be non-conservatively low for higher burnup fuel rods. Westinghouse has addressed this issue for WCGS by []

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<sup>2</sup> Bajorek, S. M., et al., Westinghouse Electric Company LLC, "Code Qualification Document for Best Estimate LOCA Analysis," WCAP-12945-P-A, March 1998 (proprietary).

**II**

As discussed in the NRC staff's safety evaluation issued with the extended power uprate license amendments for the Turkey Point Plant, Unit Nos. 3 and 4 (ADAMS Accession No. ML11293A365 and ML11293A367), PAD 4.0 + TCD was determined to produce acceptable fuel temperature inputs when compared to data from the Halden ultra-high-burnup experiment during the 1990s, which is referenced in NRC IN 2009-23, "Nuclear Fuel Thermal Conductivity Degradation," dated October 8, 2009 (ADAMS Accession No. ML091550527, which provides background information for IN 2011-21), and in IN 2009-23, Supplement 1, "Nuclear Fuel Thermal Conductivity Degradation," dated October 26, 2012 (ADAMS Accession No. ML121730336). PAD 4.0 + TCD produces acceptable input values for ASTRUM and, therefore, is appropriate for use at WCGS. The remaining ASTRUM methodology continues to be bounded by the safety evaluation documented in WCAP-16009-P-A, which is acceptable to the NRC staff.

Additionally, to address TCD **II**

**II** all 124 ASTRUM cases were run with both the first cycle and the second cycle fuel, and peaking factor burndown was credited for burnups in the range of second and third cycle fuel. The effect of TCD is that as the fuel gains exposure it is less able to transfer heat resulting in higher fuel temperatures. Peaking factor burndown credit lowers the fuel temperature because as the fuel gains exposure it will have lower levels of achievable power peaking. The peaking factor burndown credit for second and third cycle fuel is acceptable because it accounts for burnup dependent performance characteristics of the fuel.

As discussed above, the as-approved ASTRUM evaluation model (EM) contains an error, identified in NRC IN 2011-21; therefore, the NRC staff is evaluating alternative models which include the effects of fuel thermal conductivity degradation, and will require affected licensees to transition to such a model once it becomes available. For example, NRC is currently reviewing a Westinghouse LBLOCA EM and a fuel performance code that includes the effects of TCD. WCAP-16996-P, Revision 0, "Realistic LOCA Evaluation Methodology Applied to the Full Spectrum of Break Size (FULL SPECTRUM LOCA Methodology)," was submitted to the NRC on November 23, 2010 (ADAMS Accession No. ML103610186), and WCAP-17642-P, Revision 0, "Westinghouse Performance Analysis and Design Model (PAD5)," was submitted to the NRC on October 29, 2013 (ADAMS Accession No. ML13308A425). Based on the ability of the PAD 4.0 + TCD to produce acceptable input values, as discussed above, and considering the likelihood that the NRC staff will approve at least one of the updated methodologies currently under NRC review in the near-term, the NRC staff has determined that licensees may



continue to utilize PAD 4.0 + TCD while awaiting approval and adoption of a revised generic best-estimate LOCA analysis methodology and corresponding fuel performance analysis methodology (such as PAD5). This approval is subject to a new license condition, as stated in Section 3.4 below of this safety evaluation.

### 3.3 NRC Staff Evaluation

The LBLOCA analysis of record was performed for WCGS at the current licensed thermal power level of 3565 megawatts-thermal (MWt) with the 1981 Evaluation Model with BASH and predicted a PCT of 1916 degrees Fahrenheit (°F). As indicated in the most recent report<sup>3</sup> submitted by the licensee for WCGS in accordance with 10 CFR 50.46, the current licensing basis PCT plus margin allocation is 2181 °F.

The proposed LBLOCA analysis was performed with the ASTRUM evaluation methodology as modified by PAD 4.0 + TCD at the current licensed thermal power level of 3565 MWt. The limiting PCT was 1900 °F. In a supplement dated January 21, 2015, the licensee provided an estimate of the effects of errors discovered in the calculation of decay heat in the WCOBRA/TRAC code on its ASTRUM analysis. The staff has concluded that PAD 4.0 + TCD and associated modifications to the ASTRUM methodology provide assurance that the 10 CFR 50.46 criteria have been met for WCGS. The full results are tabulated below.

Parameter	ASTRUM Results	10 CFR 50.46 Limits
Peak Cladding Temperature	1900 °F	<2200 °F
Local Metal Oxidation	4.21 percent	<17 percent
Core-Wide Oxidation	0.1352 percent	<1 percent

The upper bound PCT was 1900 °F, a value that exceeded all other cases by at least 60 °F. The lowest predicted PCT from the population of runs was approximately 745 °F.

The NRC staff requested that the licensee provide input data to assess how well the code inputs reflected permissible plant operation. The licensee provided data files tabulating the analytic input and output data for each case. The staff reviewed the data provided by the licensee. Consistent with ASTRUM, TS-limited analytic inputs use a sampling range that bounds the limiting conditions for operation established for the plant. The sampling method employed in ASTRUM is based on the idea that more numerical dispersion occurs in the various WCOBRA/TRAC analyses than typically occurs at the plant, thus ensuring that the upper-bound results are generally bounding of plant operation. The staff compiled several scatter plots of various sampled input parameters as functions of PCT. The plots showed well-scattered inputs,

<sup>3</sup> Koenig, S. R., Wolf Creek Nuclear Operating Corporation, "Wolf Creek - Submission of 10 CFR 50.46 Annual Report of Emergency Core Cooling System (ECCS) Evaluation Model Changes," dated March 20, 2015 (ADAMS Accession No. ML15091A382).

and provided a reasonable confirmation that this execution of ASTRUM-generated random inputs was consistent with the generic ASTRUM input parameter sampling strategy. The data used to generate these plots are contained in the licensee's January 21, 2015, response to an NRC staff request for additional information and are being withheld from public disclosure as proprietary information.

The statistical dispersion in the input parameters and the corresponding range of PCT predictions (from 745 °F to 1900 °F) provide a general confirmation that the ASTRUM method predicts an acceptable upper tolerance limit of the predicted PCT. Additionally, the licensee stated that WCGS and its vendor, Westinghouse, continue to have ongoing processes, which ensure that LOCA analysis input values conservatively bound current operating values.

The NRC staff has reviewed the information submitted by the licensee and concluded that the ASTRUM method is NRC-approved to analyze LBLOCAs at four-loop Westinghouse plants such as WCGS. As discussed above, the NRC staff has determined that PAD 4.0 + TCD produces acceptable fuel temperature input values for ASTRUM and, therefore, is appropriate for use at WCGS. As also discussed above, the remaining ASTRUM methodology continues to be bounded by the safety evaluation documented in WCAP-16009-P-A, which is acceptable to the NRC staff. In sum, the NRC Staff has determined that the licensee's analysis performed using ASTRUM and PAD 4.0 + TCD demonstrates acceptable performance relative to the acceptance criteria of 10 CFR 50.46. In consideration of these factors and the license condition identified in Section 3.4 of this safety evaluation, the NRC staff concludes that the licensee's request to implement ASTRUM is acceptable.

### 3.4 License Condition

In accordance with 10 CFR 50.46(a)(1)(i), the licensee must reference an "acceptable evaluation model" (i.e., an NRC-approved methodology). In its July 15, 2015, supplemental letter, the licensee proposed that the following license condition be added to Renewed Facility Operating License No. NPF-42, Appendix D, "Additional Conditions," with an implementation date of within 6 months of NRC approval of a revised methodology that accounts for TCD:

Automated Statistical Treatment of Uncertainty Method (ASTRUM), as corrected for thermal conductivity degradation (TCD) including the use of PAD 4.0 + TCD, has been specifically approved for use in the WCGS licensing basis analyses. Upon NRC approval of a revised generic best-estimate loss-of-coolant accident (LOCA) analysis methodology and fuel performance analysis methodology that accounts for TCD and is applicable to the fuel in use at WCGS, WCNOC will within 6 months, either:

- (a) Demonstrate that the WCGS safety analyses remain conservatively bounded in licensing basis analyses when compared to the new generically approved version of the LOCA analysis methodology and fuel performance analysis methodology that accounts for TCD, or

- (b) Provide a schedule for re-analysis of any of the affected licensing basis analyses using the new generically approved version of the LOCA analysis methodology and fuel performance analysis methodology that accounts for TCD.

The proposed license condition is acceptable to the NRC staff because it refers to the licensee's use of an NRC-approved methodology and provides a reasonable time period for implementation once an appropriate methodology has been approved by the NRC.

### 3.5 Technical Conclusion

Based on the above, the NRC staff has concluded that it is acceptable for WCGS to incorporate Westinghouse's topical report WCAP-16009-P-A, into the list of analytical methods in TS 5.6.5.b.

### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Kansas State official, Mr. T. Conley, was notified on July 24, 2015, 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 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, published in the Federal Register on September 9, 2014 (79 FR 53462), and there has been no public comment on such finding. 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) there is reasonable assurance that 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 Contributor: J. Whitman, NRR/DSS/SRXB

Date: August 28, 2015

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A. Heflin

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Additional information on the amendment changes and the NRC staff's safety evaluations are documented in Enclosure 2 (proprietary version) and Enclosure 3 (non-proprietary version). The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

Carl F. Lyon, Project Manager  
Plant Licensing Branch IV-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosures:

1. Amendment No. 213 to NPF-42
2. Safety Evaluation (proprietary)
3. Safety Evaluation (non-proprietary)

cc w/encls 1 and 3: Distribution via Listserv

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\*via memo dated June 9, 2015

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