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**WNP-2  
Cycle 9  
Core Operating Limits Report**

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Washington Public Power Supply System

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from reduced power are calculated to be more severe than from full power conditions. A flow dependent MCPR is specified to define operating limits at other than rated flow conditions. The reduced flow MCPR limit provides bounding protection for the limiting recirculation flow increase transient.

The LHGR limits for the GE11 LFA's are the same as for the SPC 8x8 reload fuel, except that a ratio  $([64-2]/[81-7])$  is applied to account for the different number of fuel pins in the two designs. The LHGR limits for the SVEA-96 LFA's are taken directly from Reference 5.4.

The reload licensing analyses for this cycle provide operating limits for Extended Load Line (ELLLA) operation which extends the power and flow operating regime for WNP-2 up to the 109% rod line which at full power corresponds to 87% of rated flow. The MCPR limits defined in this report are applicable up to 100% of rated thermal power along and below the 109% rod line. The minimum flow for operation at rated power is 87% of rated flow. References 5.1, 5.2 and 5.35 through 5.43 document the analyses in support of ELLLA operation.

Preparation, review and approval of this report were performed in accordance with applicable Supply System procedures. The specific topical report revisions and supplements which describe the methodology utilized in this cycle specific analysis are referenced in Section 5.0

## **2.0 Average Planar Linear Heat Generation Rate (APLHGR) Limits for Use in Technical Specification 3.2.1**

The APLHGR's for use in Technical Specification 3.2.1 shall not exceed the limits shown in Figures 2.1, 2.2, 2.4, and 2.5 when in two-loop operation and in Figures 2.1, 2.3, 2.4, and 2.5 when in single loop operation. The limits for each fuel type as a function of Average Planar Exposure are provided for the SPC reload fuel, the SPC LFA's, the SVEA-96 LFA's, and the GE11 LFA's.

## 1.0 Introduction and Summary

This report provides the Average Planar Linear Heat Generation Rate (APLHGR) limits, the Minimum Critical Power Ratio (MCPR) limits, and the Linear Heat Generation Rate (LHGR) limits for WNP-2, Cycle 9 as required by Technical Specification 6.9.3.1. As required by Technical Specifications 6.9.3.2 and 6.9.3.3, these limits were determined using NRC-approved methodology and are established so that all applicable limits of the plant safety analysis are met. The thermal limits for SPC fuel given in this report are documented in the *Cycle 9 Plant Transient Analysis Report* (Reference 5.1), the *Cycle 9 Reload Analysis Report* (Reference 5.2) and the *WNP-2 Cycle 9 Coastdown Analyses* (Reference 5.44). The thermal limits determined through the approved methodology are modified for the GE11 and SVEA-96 LFA's as discussed below.

The WNP-2 Cycle 9 reload includes four Siemens Power Corporation (SPC), four General Electric (GE), and four ABB Atom (ABB) Lead Fuel Assemblies (LFA's). The SPC LFA's were inserted during the reload for Cycle 5. The GE and ABB LFA's were inserted at the beginning of Cycle 6 and were designed to be compatible with the reload fuel utilized in Cycle 6. The LFA's are loaded in core locations which analysis has shown to have sufficient thermal margin such that the LFA's are not expected to be the most limiting fuel assemblies on either a nodal or an assembly power basis. The GE11 LFA is described in the *GE11 Lead Fuel Assembly Report for Washington Public Power Supply System Nuclear Project No. 2, Reload 5, Cycle 6* (Reference 5.3). This reference describes the design goals of the GE11 LFA's and provides support for monitoring the GE11 LFA's at thermal limits based on the SPC 8x8 reload fuel thermal limits. The SVEA-96 LFA's is described in the *Supplemental LFA Licensing Report—SVEA-96 LFA's for WNP-2* (Reference 5.4). The process for developing thermal limits for the SVEA-96 LFA's based upon the SPC 8x8 reload fuel thermal limits is described in References 5.4 and 5.5.

The MAPLHGR limits for the GE11 LFA's are the same as for the SPC 8x8 reload fuel, except that a ratio  $([64-2]/[81-7])$  is applied to account for the different number of fuel pins in the two designs. The MAPLHGR limits for the SVEA-96 LFA's are the same as for the SPC 8x8 reload fuel, except that a ratio  $([64-2]/[100-4])$  is applied to account for the different number of fuel pins in the two designs. Furthermore, the MAPLHGR limits for the SVEA-96 LFA's are multiplied by the following constants: (a) 1.04 to account for a different estimation of the local power in the output from POWERPLEX compared to ABB Atom methods and (b) 1.02 to account for a different estimation of exposure in the output from POWERPLEX compared to ABB Atom methods.

The MCPR limit is the maximum of (a) the applicable exposure dependent, full power and full flow MCPR limit, (b) the applicable exposure and power dependent MCPR limit, and (c) the flow dependent MCPR limit specified in this report. This stipulation assures that the safety limit MCPR will not be violated throughout the WNP-2 operating regime. Full power MCPR limits are specified to define operating limits at rated power and flow conditions from 85% to 106% flow. For the WNP-2 core, the Load Rejection without Bypass transient is limiting for operation at rated power and flow. Power dependent MCPR limits are specified to define operating limits at other than rated power conditions. For the WNP-2 core, feedwater-controller-failure transients



- 5.25 XN-NF-87-92 and Supplement 1, *WNP-2 Plant Transient Analysis With Final Feedwater Temperature Reduction*, Advanced Nuclear Fuels Corporation, June 1987 and May 1988.
- 5.26 ANF-87-119, *WNP-2 Single Loop Operation Analysis*, Advanced Nuclear Fuels Corporation, September 1987.
- 5.27 XN-NF-79-59(P)(A), *Methodology for Calculation of Pressure Drop in BWR Fuel Assemblies*, Exxon Nuclear Company, Inc., November 1983.
- 5.28 ANF-87-118, *WNP-2 LOCA Analysis For Single Loop Operation*, Advanced Nuclear Fuels Corporation, September 1987.
- 5.29 Letter, R. B. Samworth, USNRC, to G. C. Sorensen, Supply System, *Issuance of Amendment No. 62 to Facility Operating License No. NPF-21-WPPSS Nuclear Project 2 (TAC No. 67538)*, August 5, 1988.
- 5.30 XN-NF-85-138(P), *LOCA Break Spectrum for a BWR 5*, Exxon Nuclear Company, Inc., December 1985.
- 5.31 XN-NF-85-139, *WNP-2 LOCA-ECCS Analysis, MAPLHGR Results*, Exxon Nuclear Company, Inc., December 1984.
- 5.32 ANF-CC-33(P)(A), Supplement 2, *HUXY: A Generalized Multirod Heatup Code with 10 CFR 50 Appendix K Heatup Option*, Advanced Nuclear Fuels Corporation, January 1991.
- 5.33 XN-NF-81-22(P)(A), *Generic Statistical Uncertainty Analysis Methodology*, November 1983.
- 5.34 NEDE-24011-P-A-6, *General Electric Standard Application for Reactor Fuel*, April 1983.
- 5.35 "Reactor Vessel Internals Evaluation Task Report for WNP-2 Power Uprate Project," GE Nuclear Energy, April 1993 (DRAFT).
- 5.36 "WNP-2 Power Uprate Containment Response Evaluation Input to Engineering Report," GE Nuclear Energy, January 19, 1993 (DRAFT).
- 5.37 GE-NE-189-69-1092, "Effects of Adjustable Speed Drive on Reactor Internal Vibration at the WNP-2 Nuclear Power Plant," GE Nuclear Energy, October 1992.
- 5.38 GE-NE-189-34-0392, "Jet Pump Sensing Line Vibration Test for Washington Nuclear Project 2," GE Nuclear Energy, March 1992.

- 5.39 NEDE-24222, "Assessment of BWR Mitigation of ATWS, Vol. II (NUREG 0460 Alternate No. 3)," General Electric Company, December 1979.
- 5.40 "Washington Nuclear Project Unit 2 System Evaluation Report for Power Uprate—Reactor Recirculation Control System," GE Nuclear Energy, February 1, 1993.
- 5.41 GE Report 22A7104, Revision 0, "Dynamic Load Report—Fuel Vertical Support," GE Nuclear Energy, June 30, 1982.
- 5.42 "Fuel Lift Non-Proprietary Letter," Letter, DM Kelly (GE) to WC Wolkenhauer (SS), February 15, 1993.
- 5.43 93-PU-0054, "ELLLA Related Power Uprate Task Reports," Letter, DM Kelly (GE) to WC Wolkenhauer (SS), June 3, 1993.
- 5.44 SPCWP-94-039, "WNP-2 Cycle 9 Coastdown Analyses," Letter, YU Fresk (SPC) to RA Vopalensky (SS), March 30, 1994.