STARTUP REPORT

FOR

WOLF CREEK GENERATING STATION POWER RERATE AND T_{HOT} REDUCTION

INTRODUCTION

This report describes the testing which supported the increase in licensed power at the Wolf Creek Generating Station (WCGS) from 3411 Megawatt thermal (MWt) to 3565 MWt and a decrease in Reactor Coolant System (RCS) average temperature from 588.5 °F to 581.2 °F. This report is submitted as required by Sections 6.9.1.1, 6.9.1.2, and 6.9.1.3 of the WCGS Technical Specifications.

The license amendment request for approval to operate at 3565 MWt and limiting safety system settings relating to RCS average temperature reduction was submitted on January 5, 1993 (Letter NA 93-0001, from R. C. Hagan, WCNOC, to the USNRC). This submittal contained evaluations demonstrating that the Nuclear Steam Supply System and Balance of Plant systems had been reviewed and found capable of meeting all applicable safety design bases and power generation bases, as defined in the Updated Safety Analysis Report, at the uprated conditions. This submittal was subsequently approved and issued by the NRC on November 10, 1993, as Amendment No. 69 to the WCGS Operating License.

There were two primary goals of the power rerate program: 1) increased electrical output, and 2) life extension for steam generators by reducing primary average temperature, i.e., T_{hot} reduction. Following is a summary of the results of the implementation of Amendment No. 69 to the WCGS Operating License.

IMPLEMENTATION OF THE POWER RERATE

A portion of the changes required to support the power rerate were made during the sixth refueling outage starting in March, 1993. These included: changes to technical specifications concerning overall instrument response times, replacement of electrical conductors between the main transformers and the switchyard, adding additional cooling to the main transformers, and modifying the generator output breakers due to revised amperage requirements.

An engineering calculation was performed to determine the minimum allowable RCS flow indication (less than 1.0 % adjustment) for the density change due to reduction in T_{cold}. No change was made to the low flow trip setpoints because there was sufficient conservatism in the present setpoint to accommodate the flow change due to coolant density increase in the cold leg of the RCS.

Fluxmaps were taken before rerate implementation to verify core parameters were within acceptable limits, and were compared to predicted 3565 MWt rated power to determine post rerate acceptability. Results showed sufficient margin existed to allow escalation to the new rated thermal power level.

The power rerate and T_{hot} reduction was initiated on November 17, 1993, and completed on December 21, 1993. Procedure and software changes were prepared prior to implementation of the rerate and issued during the rerate as directed by the implementing procedure. Implementation was conducted under temporary procedure TP TS-154, "Power Rerate and T_{hot} Reduction." Rescaling of components was accomplished at approximately 3240 MWt, prior

to commencement of power increase to the new design rerate power value of 3565 MWt. Plant calorimetric data was taken and Power Range Nuclear instrumentation (NI's) adjusted whenever changes were made which could affect accuracy of the NI's. WCGS was able to reach only 3417 MWt, following completion of major component and transmitter rescaling and recalibration, with the turbine control valves in the wide open condition. The plant was put in a safe, stable configuration, at this power level, prior to November 24, 1993. A plan was developed to safely increase the generator electrical output, since it was approximately 14 MWe below its electrical output prior to rerate implementation. The potential of encountering this condition had been identified prior to implementation.

After careful review by WCNOC Nuclear Engineering personnel, it was determined that T_{avg} could be safely raised, within safety limits, above the T_{ref} target value to increase steam pressure, thus resulting in an increased generator output. Procedure TP TS-154 was revised to allow T_{avg} to be raised above T_{ref}. This resulted in an increase in electrical output of about 21 MWe with reactor power at about 3480 MWt.

TESTING

Testing included collecting baseline and power ascension data on the following components: vibration for the turbine generator, feedwater pumps, condensate pumps, and reactor coolant pumps; walkdowns and inspection of pipe hangers for predetermined movement of feedwater, condensate, and steam lines; trending using the plant computer for predetermined primary and secondary component parameters; and biological shield surveys at the maximum achieved power level. The results of the testing showed the plant operated at a reduced T_{hot}, within expected ranges, and there was no noticeable increase in vibration or component degradation at the maximum achieved power level.

Balance of Plant data was taken for condensate, feedwater, main steam, and reheat steam systems. The values for this data remained within expected levels for the achieved power level. The generator and associated components were monitored during the rerate and component values remained at acceptable levels. Pipe hanger inspections on feedwater and steam lines showed no adverse pipe movements as a result of changes in flows and temperatures. The biological shield survey at the maximum achieved power level showed no change in containment radiation levels at the monitored points.

Fluxmaps were again taken at the maximum achieved power level to verify core parameters were within acceptable limits. Results showed acceptable margins existed for F_q and $F_{\Delta h}$, and the core to be performing within acceptable design limits.

Preliminary full power ΔT's were extrapolated from measured values at approximately 3240 MWt with T_{avg} at the new lower reference value, and input into the reactor protection circuitry. Operation at the maximum achievable power level resulted in numerous ΔT and T_{avg} deviation alarms. This had been anticipated due to power effects on the upper plenum anomaly. The T_{avg} deviation alarms were investigated by Reactor Engineering personnel and deviation setpoints raised to prevent nuisance alarms. The ΔT alarms were addressed by the final calibration of ΔT. Final values for ΔT's were extrapolated to 100% of rated thermal power after determination of maximum achievable power level with turbine control valves in the wide open condition and T_{avg} above T_{ref}. Final ΔT values were within 0.5% of calorimetric power values at the maximum achieved power level.

Turbine impulse pressure and T_{ref} were not rescaled to the new power level with the turbine control valves in the valves wide open condition and increased T_{avg} condition. An examination of allowable operation with T_{avg} $\leq$ 3°F above T_{ref} verified agreement with the design values.

A license amendment request was submitted on February 7, 1994 (Letter NA 94-0018, from R. C. Hagan, WCNOC to the USNRC) to decrease the 5°F T_{hot} reduction requested in our original submittal. This submittal includes additional revisions to rerate parameter setpoints (e.g., Overpressure ΔT and Overtemperature ΔT). These changes will allow WCGS to achieve its goal of increase electrical output for the remainder of Cycle 7. An additional report describing actions taken to achieve 3565 MWt will be submitted within 90 days of completion of those actions.