WOLF CREEK
NUCLEAR OPERATING CORPORATION

Russell A. Smith
Site Vice President and Chief Nuclear Operating Officer

February 25, 2013
WO 13-0010

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

Reference:
1) Letter WO 12-0066, dated November 21, 2012, from R. A. Smith, WCNOC, to USNRC

2) Letter dated February 1, 2013, from C. F. Lyon, USNRC, to M. W. Sunseri, WCNOC, "Wolf Creek Generating Station – Request for Additional Information Re: Revision to Technical Specification 3.4.12, "Low Temperature Overpressure Protection (LTOP) System" (TAC NO. MF0309)"

Subject: Docket No. 50-482: Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specification (TS) 3.4.12, "Low Temperature Overpressure Protection (LTOP) System"

Gentlemen:

Reference 1 provided Wolf Creek Nuclear Operating Corporation's (WCNOC) application to revise Technical Specification (TS) 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," to reflect the mass input transient analysis that assumes an Emergency Core Cooling System (ECCS) centrifugal charging pump (CCP) and the normal charging pump (NCP) capable of injecting into the Reactor Coolant System during the TS 3.4.12 Applicability. Reference 2 provided a Nuclear Regulatory Commission (NRC) request for additional information related to the application. Attachment I provides WCNOC's response to the request for additional information.

The additional information does not expand the scope of the application as originally noticed, and does not impact the no significant hazards consideration determination presented in Reference 1.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," a copy of this submittal is being provided to the designated Kansas State official.

A001
NRR

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4156, or Mr. Michael J. Westman at (620) 364-8831 ext. 4009.

Sincerely,

Russell A. Smith

RAS/rlt

Attachment

cc: E. E. Collins (NRC), w/a
T. A. Conley (NRC), w/a
C. F. Lyon (NRC), w/a
N. F. O'Keefe (NRC), w/a
Senior Resident Inspector (NRC), w/a

STATE OF KANSAS)
) SS
COUNTY OF COFFEY)

Russell A. Smith, of lawful age, being first duly sworn upon oath says that he is Site Vice President and Chief Nuclear Operating Officer of Wolf Creek Nuclear Operating Corporation; that he has read the foregoing document and knows the contents thereof; that he has executed the same for and on behalf of said Corporation with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By [signature]
Russell A. Smith
Site Vice President and Chief Nuclear Operating Officer

SUBSCRIBED and sworn to before me this 25th day of February, 2013.

OFFICIAL SEAL
RHONDA L. TIEMEYER
MY COMMISSION EXPIRES
January 11, 2014

Rhonda L. Tiemeyer
Notary Public

Expiration Date January 11, 2014

Response to Request for Additional Information

Reference 1 provided Wolf Creek Nuclear Operating Corporation's (WCNOC) application to revise Technical Specification (TS) 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," to reflect the mass input transient analysis that assumes an Emergency Core Cooling System (ECCS) centrifugal charging pump (CCP) and the normal charging pump (NCP) capable of injecting into the Reactor Coolant System (RCS) during the TS 3.4.12 Applicability. Reference 2 provided a Nuclear Regulatory Commission (NRC) request for additional information related to the application. The specific NRC question is provided in italics.

1. *The licensee proposes to change NOTE 1 to Technical Specification 3.4.12 in such a way as to allow, for up to one hour, three charging pumps to be capable of injection into the reactor coolant system. Please explain whether the mass input analysis of record addresses this condition. If it does not, please provide a justification for the revising the note.*

Response: The proposed change to Note 1 to the Limiting Condition for Operation (LCO) is considered to be an editorial change to clearly indicate that the Note applies only to the ECCS CCPs. Since original plant licensing in 1985 WCNOC has considered the terminology "centrifugal charging pump" and "CCP" as only referring to the safety related ECCS CCPs. The mass input transient analysis of record did not specifically analyze both ECCS CCPs and the NCP being capable of injecting into the RCS. The mass input transient analysis of record only analyzed one ECCS CCP and the NCP being capable of injecting into the RCS.

Note 1 to the LCO allows a 1-hour exception from the mass input transient analysis pump flow input assumptions to allow ECCS CCP swap operations. The NCP is normally inservice to maintain the charging and letdown functions of the Chemical and Volume Control System. One ECCS CCP is OPERABLE/FUNCTIONAL and capable of injecting into the RCS but is not in operation. During a typical refueling outage, maintenance activities are performed during train (train 'A' or train 'B' safety related equipment) related windows. When the maintenance activities are completed and the train 'A' equipment is restored to service, then train 'B' equipment is taken out of service. Performing ECCS CCP swap operations for maintenance activities requires both CCPs to be capable of injecting for a limited period of time. During the time allowed for pump swap operation, the inoperable/nonfunctional CCP must first be restored to OPERABLE status to meet LCO 3.5.3, "ECCS-Shutdown," and Technical Requirement (TR) 3.1.10, "Boration Injection System – Shutdown." TR 3.1.10 requires one boration injection subsystem (one ECCS CCP) be FUNCTIONAL in MODES 4, 5, and 6.

Prior to the improved TSs (Amendment No. 123 (Reference 3)), TS 3/4.5.4, "ECCS SUBSYSTEMS – T_{avg} <200°F," required: "All Safety Injection pumps and one Centrifugal Charging Pump shall be inoperable." Action b. required "With two Centrifugal Charging Pumps OPERABLE, restore one of the Centrifugal Charging Pumps to an inoperable status within 4 hours." The conversion to the improved TS utilized Revision 1 of NUREG, 1431, "Standard Technical Specifications Westinghouse Plants." TS 3.4.12, Condition B, included a Note to Required Action B.1 indicating that two charging pumps may be capable of injecting into the RCS during pump swap operation for ≤ 15 minutes. Technical Specification Task Force (TSTF) traveler TSTF-285-A, Rev. 1, "Charging Pump Swap LTOP Allowance," relocated the Note from Required Action B.1 to the LCO. The justification associated with the NRC-approved TSTF-285 allowance to have "N+1" pumps capable of injecting indicates that the mass input transient analysis is taken into consideration in conjunction with other functions that require an

OPERABLE ECCS CCP such that one hour to perform the pump swap operation is reasonable considering the small likelihood of an event during this brief period and other actions available (e.g., operator action to stop any pump that inadvertently starts).

2. *Please provide a more detailed summary of the mass input analysis that is discussed in Attachment I, Section 3, of the November 21, 2012, letter. Please include a description of the significant inputs to the analysis, explain how the LOFTRAN code was used (i.e., by referencing an NRC-approved methodology), provide key plots of the results, characterize any significant modeling assumptions, and explain how the results conform to the applicable acceptance criteria.*

Response: The function of the LTOP System is to protect the reactor vessel from fast propagating brittle fracture. This has been implemented by choosing LTOP PORV setpoints which prevent exceeding the limits prescribed by the applicable pressure/temperature characteristic for the specific reactor material in accordance with 10 CFR 50 Appendix G. A typical characteristic Appendix G curve shows that the allowable system pressure increases with increasing temperature. This type of curve sets the nominal upper limit on the pressure which should not be exceeded during RCS increasing pressure transients. The LTOP PORV setpoints are determined based on heatup and cooldown limit curves and results from the mass input transient analysis. The information below describes the use of the mass input transient analysis in developing the LTOP PORV setpoints.

Introduction

The mass input transient is initiated by the failure of the charging pump (either ECCS CCP or NCP) controls that results in the flow control valve in the letdown line failing closed (letdown isolation) and the flow control valve in the charging line failing open (maximum charging flow). The influx of flow into the relatively inelastic water solid RCS results in a sudden increase in primary system pressure.

Input Parameters and Assumptions

Consistent with the methodology outlined in WCAP-14040-A (Reference 4), the following major assumptions and key parameters were used in the mass input analyses:

1. The design basis for the LTOP system assumes that the Residual Heat Removal (RHR) System is isolated from the RCS, and thus the relief capability of the RHR System relief valves is not available.

2. An initial RCS temperature of 60°F is assumed for the mass input transient, as the LTOP/Power Operated Relief Valve (PORV) setpoints are selected so that the Appendix G limit will not be exceeded down to the minimum reactor vessel bolt-up temperature of 60°F.

3. The mass injection rate assumed in the design basis mass input transient is based on 100% flow capacity of the NCP and one ECCS CCP. The maximum combined pump flow has been assumed in order to envelop the maximum flow possible by the operational configuration that uses the NCP for charging with one CCP remaining OPERABLE, or the use of one CCP for charging with the NCP remaining OPERABLE, during shutdown modes. The injection flowrates over a range of RCS pressures are provided in Table 1.

4. Based on the single failure criteria, only one pressurizer PORV is assumed to be available to mitigate the transients. The following valve characteristics were assumed:

   Ramp (linear) opening characteristics
   Opening time = 2 seconds, including a 0.9 second delay
   Closing time = 2 seconds, including a 0.9 second delay
   Flow coefficient, Cv = 50 gpm/$\sqrt{\text{psi}}$

5. The RCS is assumed to be enclosed by a non-yielding, inelastic boundary. The pressurizer is assumed to be in a water solid condition and at the same temperature as the reactor coolant. This maximizes the pressure overshoots during the design basis transients.

<u>Analyses and Evaluations</u>

The NRC approved LOFTRAN code, described in WCAP-7907-P-A (Reference 5), is used to calculate the pressure overshoot and undershoot beyond the PORV open and close setpoints as a result of time delays in signal processing and valve stroke following a design basis mass input transient. The computer analyses of the plant specific design basis mass input transients were performed and the PORV setpoint overshoots and undershoots are developed for a series of assumed PORV setpoints and a range of mass input rates. The key plant parameters: the design basis mass input rates, the plant RCS volumes, pressurizer PORV opening and closing stroke times, PORV characteristics, and instrument delay times as mentioned above are utilized for the development of the mass input transient database and the results are presented in Table 2. Figure 1 shows a typical pressure response for a mass input transient. When a PORV is actuated to mitigate an increasing pressure transient, the release of a volume of coolant through the valve will cause the pressure increase to be slowed and reversed. The system pressure then decreases, as the relief valve releases coolant, until a reset pressure is reached where the valve is signaled to close. Note that the pressure continues to decreases below the reset pressure as the valve re-closes.

The maximum expected pressure overshoot and undershoot calculated from the limiting mass input transient, in conjunction with the heatup and cooldown limit curves, are utilized in the selection of the pressure setpoints for the LTOP System. The acceptance criteria for the LTOP PORV setpoints is that the peak RCS pressure resulting from the design basis mass input transient, with uncertainties and the pressure drop between the wide range pressure transmitters and the reactor vessel mid-plane accounted for, shall not exceed the 10 CFR 50 Appendix G limits.

The limiting LTOP PORV setpoints are developed in steps as follows, based on:

1. The Appendix G limits as a function of temperature are provided in the Limit A column of Table 3.

2. The instrument uncertainties (110 psi) are applied. Results are given in the Limit B column of Table 3.

3. The Limit C column values given in Table 3 account for the pressure difference between the wide range pressure transmitter and the reactor vessel limiting beltline region, depending on number of RCPs running.

4. The pressure overshoot is then calculated based upon the values provided in the Limit C column of Table 3. Specifically, the pressure is used to obtain the mass flow rate as a function of pressure (Table 1). Using the mass flow rate and the allowable pressure value given in the Limit C column of Table 3, the pressure overshoot is obtained from the information given in Table 2. Note that since the pressures given in the Limit C column of Table 3 do not exactly equal the pressure ranges in Table 2, interpolation is used to obtain the pressure overshoot value.

5. Superimposing the pressure overshoot for a design basis mass input/heat input transient to the RCS, a range of allowable PORV setpoints can be determined. The results are tabulated in the Maximum Allowable Setpoint column of Table 3.

Results

There are no specific acceptance criteria for the mass input analysis. However, the results are used to determine the maximum allowable PORV setpoint pressure as a function of RCS temperature to ensure that the RCS pressure does not exceed the Appendix G limits. The maximum PORV setpoint calculation includes instrument uncertainties, pressure differences between the wide range pressure transmitter and reactor vessel limiting beltline region, and pressure overshoot due to the mass input transient.

References:

1. WCNOC Letter WO 12-0066, "License Amendment Request To Revise Technical Specification 3.4.12, "Low Temperature Overpressure Protection (LTOP) System"," November 21, 2012. ADAMS Accession No. ML12334A406.

2. Letter from C. F. Lyon, USNRC, to M. W. Sunseri, WCNOC, "Wolf Creek Generating Station – Request for Additional Information Re: Revision to Technical Specification 3.4.12, "Low Temperature Overpressure Protection (LTOP) System" (TAC NO. MF0309)," February 1, 2013. ADAMS Accession No. ML13030A062.

3. Letter from J. N. Donohew, USNRC, to O. L. Maynard, WCNOC, "Conversion to Improved Technical Specifications for Wolf Creek Generating Station – Amendment No. 123 to Facility Operating License No. NPF-42 (TAC NO. M98738)," March 31, 1999. ADAMS Accession No. ML022050061.

4. WCAP-14040-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," J.D. Andrachek, et al., May 2004.

5. WCAP-7907-P-A, "LOFTRAN Code Description," Burnett, T. W. T., et al., April 1984.

Table 1 – Combined Injection Flow Rates

RCS Pressure (psig)	Injection Flow Rate (gpm)		
	ECCS CCP Flow	NCP Flow	Total Flow
350	438.28	217.17	655.45
400	434.16	213.58	647.74
450	429.98	210.02	640.00
500	425.72	206.50	632.23
550	421.39	203.03	624.42
600	416.98	199.59	616.57
800	398.51	186.27	584.78
1200	356.76	161.83	518.59

Table 2 – Mass Input Transient Results

MI Flow Rate (gpm)	PORV Setpoint (psig)	Setpoint Pressure Overshoot (psi)	Peak RCS Pressure (psig)	Setpoint Pressure Undershoot (psi)	Minimum RCS Pressure (psig)
500	400	59	459	70	330
600	400	72	472	61	339
650	400	75	475	52	348
670	400	78	478	52	348
700	400	84	484	49	351
500	500	55	555	84	416
600	500	68	568	71	429
650	500	73	573	66	434
670	500	75	575	63	437
700	500	77	577	60	440
500	600	53	653	91	509
600	600	65	665	80	520
650	600	70	670	75	525
670	600	72	672	71	529
700	600	76	676	69	531
500	700	51	751	100	600
600	700	62	762	88	612
650	700	68	768	83	617
670	700	70	770	80	620
700	700	74	774	78	622
500	800	49	849	108	692
600	800	60	860	96	704
650	800	65	865	91	709
670	800	68	868	88	712
700	800	70	870	85	715

Table 3 - Maximum Allowable Setpoint for Appendix G Protection

Steady State Temp. (°F)	Limit_A (psig)(1)	Limit_B (psig)(2)	Limit_C (psig)(3)	ΔP_{over} Setpoint Pressure Overshoot (psi)(4)	Maximum Allowable Setpoint (psig)
60	621	511	508.21	70.85	437.36
70	621	511	508.21	70.85	437.36
80	621	511	508.21	70.85	437.36
90	621	511	508.21	70.85	437.36
100	621	511	508.21	70.85	437.36
110	621	511	497.07	71.35	425.72
120	621	511	497.07	71.35	425.72
130	621	511	497.07	71.35	425.72
140	621	511	497.07	71.35	425.72
140	1387	1277	1263.07	128.00	1135.07
150	1560	1450	1436.07	128.00	1308.07
160	1771	1661	1647.07	128.00	1519.07

Notes:
1. Steady state 10 CFR 50 Appendix G cooldown/heatup limit
2. Limit_B = Limt_A - 110, accounting for pressure uncertainty (110 psi)
3. Limit_C = Limit_B -13.93, accounting for pressure differential for 4 reactor coolant pumps (RCP) running above 100°F, or Limit_B - 2.79, accounting for pressure differential for 2 RCPs running below 100°F
4. Based on the mass input transient results presented in Table 2 above and the limiting pressure overshoot resulting from a design basis heat input transient for RCS temperature > 140°F

Figure 1 – Typical Pressure Transient for one PORV Cycle