WOLF CREEK
NUCLEAR OPERATING CORPORATION

Forrest T. Rhodes
Vice President Engineering

May 27, 1993
ET 93-0064

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-137
Washington, D. C. 20555

Subject: Docket No. 50-482: Licensee Event Report 93-008-00

Gentlemen:

The attached Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73 (a) (2) (i) (B) concerning a violation of the Wolf Creek Generating Station Technical Specifications.

Very truly yours,

Forrest T. Rhodes
Vice President Engineering

FTR/jra

Attachment

cc: W. D. Johnson (NRC), w/a
J. L. Milhoan (NRC), w/a
G. A. Pick (NRC), w/a
W. D. Reckley (NRC), w/a

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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Wolf Creek Generating Station	0 5 0 0 0 4 8 2	1 OF 0 8

TITLE (4)

Flux Doubling circuit required for Modes 3, 4, and 5 was "blocked" for several days.

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 4	2 7	9 3	9 3	0 0 8	0 0	0 5	2 7	9 3		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(ix)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
Mr. Kevin J. Moles	3 1 1 6 3 6 4 - 8 3 1 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On April 27, 1993, at 1321 CDT, Instrumentation and Control (I&C) Technicians began performing surveillance test procedure STS IC-725A, "7300 Process and N.I. Response Time Test (2/4 Logic) Protection Set I," Revision 5. At 1335 CDT, Control Room Operators blocked both channels of Flux Doubling [SE-RA]. However, the requirements of Wolf Creek Generating Station (WCGS) Technical Specification Limiting Condition for Operation (LCO) Table 3.3-1 Action Statement 5b. were not performed as required. Flux Doubling was reinstated at 1907 CDT.

On April 28, 1993, a similar incident occurred during performance of surveillance test procedure STS IC-725C, "7300 Process and N.I. Response Time Test (2/4 Logic) Protection Set III," Revision 6. Operators blocked both channels of Flux Doubling at 0412 CDT. Once the error was brought to the attention of the Control Room Crew they initiated Technical Specification 3.3.1 Table 3.3-1 Action 5b., to determine the SHUTDOWN MARGIN. However, the SHUTDOWN MARGIN determination was not completed within the required one hour time frame. The requirements of Technical Specification 3.3.1 Action 5b. were completed at 0628 CDT. The remaining action requirements were completed within the four hour time limit.

The root cause of this event is a misunderstanding of the applicability of Technical Specification 3.3.1 as specified in Table 3.3-1, Item 6.b., which states the requirements for source range neutron flux instrumentation while in Modes 3, 4, and 5. To avoid future misunderstandings I&C will enhance their procedures to reference Technical Specification 3.3.1, and to emphasize that these requirements must be met if Flux Doubling is to be blocked or bypassed. In addition, alarm response procedure ALR 00-57B, "SR Flux Doubled BYP/BLOC," will also be revised to reference Technical Specification 3.3.1.

PLANT CONDITIONS AT THE TIME OF EVENT:

Plant Operational Condition: MODE 5 (Cold Shutdown)
Reactor Coolant System Pressure: 50 psig
Reactor Coolant System Temperature: < 120 degrees Fahrenheit
Reactor Coolant System Water Level: Pressurizer "Solid"

DESCRIPTION OF EVENT:

On April 27, 1993, at 1321 CDT, Instrumentation and Control (I&C) Technicians began performing surveillance test procedure STS IC-725A, "7300 Process and N.I. Response Time Test (2/4 Logic) Protection Set I," Revision 5, to ensure the response times of the analog channels which generate the 2 out of 4 reactor trip and engineered safety feature functions are within requirements. The I&C Technician discussed with a Control Room Operator that the Flux Doubling swapover would occur and that the procedure would allow the Flux Doubling signal to be blocked.

At 1335 CDT, both channels of Flux Doubling were blocked. The precaution and limitation steps (2.2 and 2.2.1) in procedure STS IC-725A were not completed. Procedure STS IC-725A step 2.2 states, "If the Boron Dilution Flux Doubling System is operable, Charging Pump Suction Swapovers will occur when Function Selector Switches are rotated by this procedure. NORMAL suction can be restored as soon as the Actuation Signal CLEARS." In addition, step 2.2.1 specifies that the requirement of Wolf Creek Generating Station Technical Specification LCO Table 3.3-1 Action Statement 5b. must be satisfied. Technical Specification Action 5b. states, "With no channels OPERABLE, open the Reactor Trip Breakers, suspend all operations involving positive reactivity changes and verify compliance with the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2, as applicable, within 1 hour and every 12 hours thereafter, and verify valves BG-V178 [CB-ISV] and BG-V601 [CB-ISV] are closed and secured in position within 4 hours and verified to be closed and secured in position every 14 days." However, the requirements of Technical Specification 3.3.1, Table 3.3-1, Action 5b. were not met. Operators reinstated Flux Doubling at 1907 CDT.

On April 28, 1993, a similar incident occurred during performance of STS IC-725C, "7300 Process and N.I. Response Time Test (2/4 Logic) Protection Set III," Revision 6. Control Room Operators blocked both channels of Flux Doubling at 0412 CDT. The Control Room Operators initiated Technical Specification 3.3.1, Table 3.3-1, Action 5b., to determine the SHUTDOWN MARGIN. However, this action was not completed within the required one hour time frame. It was completed at 0628 CDT, approximately one hour and 16 minutes late. However, the remaining action requirements, which verified valves BG-V178 and BG-V601 were locked closed, were completed within the four hour time limit at 0632 CDT. Valves BG-V178, "Reactor Makeup Water to Chemical Mix Tank/Boric Acid Blending Isolation Valve", and BG-V601, "Reactor Makeup Water to the Boric Acid Blending Tank Upstream Isolation

Valve" of the Chemical and Volume Control System (CVCS) [CB] are verified closed and secured to ensure Reactor Make-up Water System (RMWS) [CB] flow to the Volume Control Tank (VCT) [CB] is terminated to prevent the initiation of an inadvertent boron dilution event under test conditions (with both channels of Flux Doubling blocked).

As in the first incident, the I&C Technician had discussed with the Control Room Operator that the Flux Doubling swapover would occur and that the procedure would allow the Flux Doubling signal to be blocked. However, during the second incident the Shift Outage Manager overheard the conversation between the Control Room Operator and the I&C Technician and questioned the Operator. Since the Technical Specification did not clearly address the applicability of Flux Doubling a subsequent discussion was held with the Manager Operations when he came into the Control Room at 0600 CDT. The Manager Operations then informed the Control Room Operators that the requirements of Technical Specification 3.3.1 Table 3.3-1 Action 5b. were applicable. The control room crew then completed the requirements. Flux Doubling was restored at 1002 CDT with the completion of procedure STS IC-725C and the Technical Specification 3.3.1 LCO was exited.

ROOT CAUSES AND CONTRIBUTING FACTORS

The root cause of this event is cognizant personnel error by licensed Control Room Operators in that there was a misunderstanding of the applicability of Technical Specification 3.3.1 as specified in Table 3.3-1, Item 6.b., which states the requirements for source range neutron flux instrumentation while in Modes 3, 4, and 5. The specification only references Flux Doubling by stating that it can be administratively blocked in Mode 3 for plant startup. This reference to Flux Doubling, per Table 3.3-1 Note "**", is associated with Mode 3 only. Technical Specification 3.3.1, Table 3.3-1, Action 5b. does not discuss the impact of Flux Doubling.

Contributing to this event is the action required when Flux Doubling is blocked. The suspension of all operations involving positive reactivity addition is required as well as verification that CVCS valves BGV-601 and BGV-178 are closed. When these valves are closed the addition of Reactor Make-up Water to the CVCS is prohibited. The boron concentration in the Reactor Coolant System (RSC) [AB] was higher than in the Refueling Water Storage Tank (RWST) [CB-TK]. Therefore, the Control Room was concerned that if the RCS required make-up water (with the RMWS isolated from the VCT) and the RWST was needed as a source of water this would be an inadvertent positive reactivity addition, causing a Technical Specification violation.

CORRECTIVE ACTIONS

Corrective Actions Completed:

As an immediate corrective action, Operations' personnel issued a memo to all Shift Supervisors and Supervising Operators on April 29, 1993. The memo specifically states that whenever both trains of Flux Doubling are blocked, Technical Specification 3.3.1, Table 3.3-1, Action 5b. must be complied with; and that whenever one train of Flux Doubling is blocked, Technical Specification 3.3.1 Action 5a. must be complied with. The memo also reinforced that Flux Doubling is a requirement in Modes 4 and 5 and in Mode 3 until it is blocked for startup.

Operations had prior to these events initiated a change to the WCGS Technical Specification Bases to allow make-up to the RCS with water of a lower boron concentration as long as the make-up water's boron concentration is greater than or equal to minimum required RWST concentration. The Boron Dilution Bases change was submitted to the NRC by WCNOC via letter NA 92-0122, dated December 22, 1992. This Technical Specification Bases change is still under review by the NRC Office of Nuclear Reactor Regulation.

Operations revised Alarm Response Procedure ALR 00-57B, "SR Flux Doubled BYP/BLOC", Revision 2, to reference Technical Specification 3.3.1 on May 25, 1993.

Operations management issued a memo on May 19, 1993, to Operations personnel emphasizing the importance of reading the "Precautions and Limitations" section in all procedures.

Future Corrective Actions:

I&C will enhance their procedures to reference Technical Specification 3.3.1, and to emphasize that these requirements must be met if Flux Doubling is to be blocked or bypassed. Temporary/permanent procedures have already been submitted for fifteen STS IC procedures known to be affected. This revision will be completed by August 2, 1993.

An explanation of Technical Specification 3.3.1, Table 3.3-1 Item 6.b., will be incorporated into Operator training prior to the next refueling outage in a course called "Refueling Concerns" which is scheduled to be complete by October 1, 1994.

SAFETY ANALYSIS

The instrumentation and control systems provide automatic protection and exercise proper control against unsafe and improper reactor operation during steady state and transient power operations and provide initiating signals to mitigate the consequences of emergency and faulted conditions. Besides the Reactor Trip System (RTS) and Engineered Safety Feature Actuation Systems (ESFAS), there are other instrumentation systems that are required for reactor safety, as defined in Updated

Safety Analysis Report (USAR), Section 7.1.1.5. These systems and components serve in a preventive role in reducing the effects of postulated accidents.

Per USAR, Section 7.1.1.5, instrumentation for mitigating the consequences of an inadvertent boron dilution event are a part of these required safety systems. This system is described in USAR Section 7.6.12.

Instrumentation is provided to mitigate the consequences of an inadvertent addition of unborated, primary grade water into the RCS. The attached figure (Figure 1) is a simplified block diagram of the boron dilution control system at WCGS taken from USAR Figure 7.6-6. This figure shows the Flux Doubling detection system and the protection system output for the associated isolation valve actuations of RWST/CVCS.

In the event of a boron dilution transient, the Source Range Neutron Flux Instrumentation, in conjunction with the 2Φ meter, detects a doubling of the neutron flux. This information is sent to the solid state protection system which automatically initiates isolation valve movement to terminate the event. Also, an alarm is sounded in the Control Room for plant operators to indicate that Flux Doubling has occurred and isolation valve movement has started. In the analysis of a boron dilution event, credit is taken for the instrumentation to provide for operator alert and for automatically initiating appropriate isolation valve movement.

The analyses of the effects of possible reactivity control malfunctions for WCGS are discussed in Chapter 15 of the USAR. Section 15.4.6, "Chemical and Volume Control System Malfunction that Results in a Decrease in the Boron Concentration in the Reactor Coolant," describes the analysis applicable to this event. One principle means of positive reactivity insertion into the core is the addition of unborated, primary grade water from the demineralizer and RMWS into the RCS through the reactor make-up portion of the CVCS.

The means of causing an inadvertent boron dilution are the opening of the primary water make-up control valve and failure of the blend system, either by controller or mechanical failure. The CVCS and RMWS are designed to limit, even under various postulated failure modes, the potential rate of dilution to values which, with indication by alarms and instrumentation, will allow sufficient time for automatic or operator response (depending on the mode of operation) to terminate the dilution. An inadvertent dilution from the RMWS may be terminated by closing the primary water make-up control valve. Sources of dilution may be terminated by closing isolation valves in the CVCS, BG-LCV-112B and C. Other dilution paths are controlled by locked closed valves. The lost shutdown margin (SDM) may be regained by the opening of isolation valves to the RWST, BN-LCV-112D and E, thus allowing the addition of a minimum 2400 ppm borated water to the RCS.

Dilution During Cold Shutdown (Mode 5)

The following conditions are assumed for inadvertent boron dilution while in this operating mode:

a. Dilution flow is limited by a flow orifice in the RMWS to 150 gpm of unborated water (i.e., BG-V178 is closed and BG-V601 is open).

b. An RCS water volume of 3400 ft^3. This is a conservative estimate of the minimum active volume of the RCS and corresponds to the water level drained to mid-nozzle in the vessel while on one train of RHR.

c. The differential boron worth is conservatively assumed consistent throughout the dilution event and equal to 13.5 pcm/ppm.

d. The minimum shutdown margin is assumed in accordance with Technical Specifications and equals 1.3% $\Delta k/k$.

Combining the above assumptions with the time required for the automatic protection system to mitigate the event yields a maximum allowable initial boron concentration of 1918 ppm per the USAR. The corresponding critical boron concentration is 1844 ppm per the USAR.

In the event of an inadvertent boron dilution transient while in this mode of operation, the source range nuclear instrumentation will detect a doubling of the neutron flux by comparison of the current source range flux to that of approximately 10 minutes earlier. Upon detection of the Flux Doubling, an alarm is sounded for the operator, and valve movement to terminate the dilution and start boration is automatically initiated. Under the conditions defined above, these actions will occur approximately 2.5 minutes after start of dilution. Valves BN-LCV-112D and E (isolation valves to the RWST) are opened to supply borated water to the suction of the charging pumps, and valves BG-LCV-112B and C (isolation valves in the CVCS) are closed to terminate the dilution. These automatic actions are carried out to minimize the approach to criticality and regain the lost shutdown margin. Action taken by the operator is to terminate boration after regaining the required shutdown margin and determine and correct the cause of the dilution transient.

During the events described in this Licensee Event Report (LER), several important differences exist between actual conditions and those assumed in the USAR Section 15.4.6 analysis, as follows:

* The Flux Doubling logic channels were blocked for about 5 hours and 46 minutes during the performance of procedure STS IC-725A on April 27, 1993. Thus, the auto-termination of a postulated boron dilution event and the auto-switchover of the charging pump suction from the VCT to the RWST would not have occurred. However, an inadvertent boron dilution event did not occur during this time.

* The Flux Doubling logic channel was blocked for about 5 hours and 50 minutes during the performance of STS IC-725C on April 28, 1993. In this case, Technical Specification 3.3.1 Actions were performed. Specifically,

valves BG-V178 and BG-V601 were verified secured and locked closed within 2 hours and twenty minutes (in accordance with Technical Specification 3.3.1 Action 5b.), thus terminating the potential for an inadvertent boron dilution event from the RMWS. Also, although the verification of shutdown margin was completed one hour and 16 minutes late, there were no changes noted from the calculation.

- On both occasions, RCS Boron Concentration was well above that assumed in the USAR Section 15.4.6 analysis (i.e., about 2479 ppm on April 27, 1993, and about 2468 ppm on April 28, 1993) for maximum allowed initial boron concentration (1918 ppm). The time to reach the assumed critical boron concentration (1844 ppm), had an inadvertent boron dilution event occurred, would have been significantly greater as a result.

- On both occasions, the Source Range Neutron Flux Instrumentation was operable per Technical Specifications and indications of source range flux levels were available to the Control Room Operators. No appreciable changes in source range counts occurred during these times.

- On both occasions, the RCS was "solid". Thus, the active volume of the RCS was significantly greater than the minimum value assumed in the transient analysis. Again, this would have had a considerable effect on the time to reach a critical boron concentration had an inadvertent boron dilution event occurred (which it did not, in either case).

- Had an inadvertent boron dilution event occurred, sufficient information was available to the operator to take manual actions to terminate the event in a timely manner and initiate boration as required.

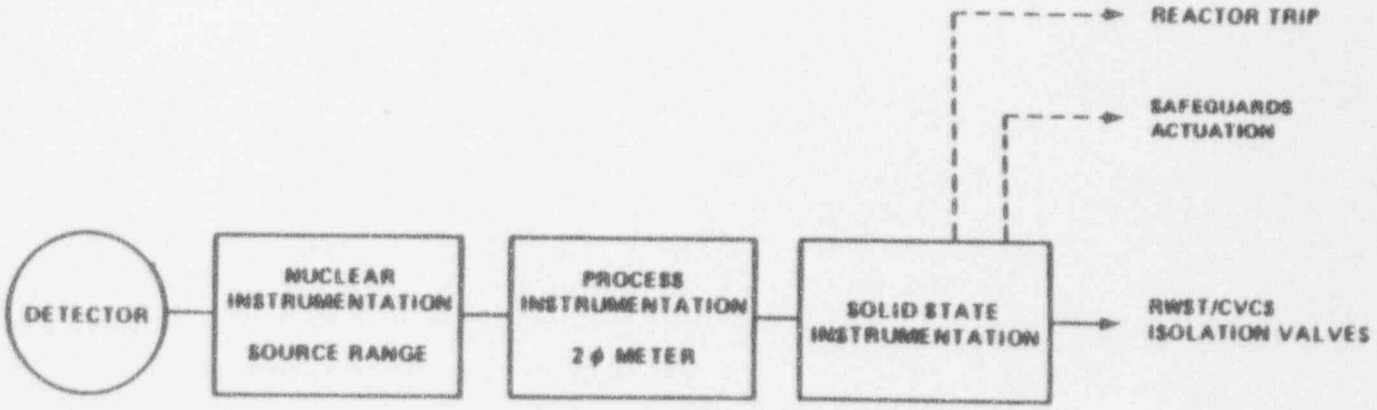
Based on the above, these two conditions did not result in any adverse consequences to the plant. Plant safety and public health and safety were assured throughout both events.

PREVIOUS SIMILAR OCCURRENCES

There have been no previous similar reported occurrences at WCGS.

Wolf Creek Generating Station
LER 93-008-00

Figure 1



WOLF CREEK
UPDATED SAFETY ANALYSIS REPORT

FIGURE 7.6-6

INSTRUMENTATION FOR PROTECTION AGAINST INADVERTENT BORON DILUTION