January 21, 2004

Mr. Rick A. Muench
President and Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – TEST RESULTS FOR THE WITHDRAWAL OF SURVEILLANCE CAPSULE X (TAC NO. MB8455)

Dear Mr. Muench:

By letter dated April 8, 2003 (RA 03-0041), Wolf Creek Nuclear Operating Corporation (the licensee) submitted its report on reactor pressure vessel (RPV) surveillance Capsule X to the NRC in accordance with the requirement in 10 CFR Part 50, Appendix H. Capsule X was withdrawn from the reactor pressure vessel of Wolf Creek Generating Station at the end of Refueling Outage No. 12. The submitted report is WCAP-16028, "Analysis of Capsule X from Wolf Creek Nuclear Operating Corporation, Wolf Creek Reactor Vessel Radiation Surveillance Program," Revision 0, dated March 2003.

The staff review of WCAP-16028 focused on the following: (1) validate the licensee's fluence calculation, (2) verify and compile the new and revised information on surveillance data in a format ready for updating the Reactor Vessel Integrity Database (RVID), and (3) review or perform the chemistry factor calculation based on the added surveillance data to assess the adequacy of the current pressure-temperature limits, pressurized thermal shock and upper shelf energy evaluation.

As documented in the enclosed evaluation, the staff has reviewed the report and found it acceptable. The staff concludes that the licensee's fluence calculation is acceptable and there will not be any significant impact on reactor vessel integrity due to the report results. The staff also compiled the new surveillance data for Capsule X and generated a table for RVID updating, which is attached to the enclosure. This closes out TAC No. MB8455. If you have any questions concerning this letter, contact me at 301-415-1307, or through the internet, at jnd@nrc.gov.

Sincerely,
/RA/
Jack Donohew, Senior Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure: Evaluation of Wolf Creek Capsule X Report

cc w/encl: See next page

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cc w/encl: See next page

* EMCB memorandum dated 12/15/2003
SRXB memorandum dated 11/07/2003

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EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO CAPSULE X SURVEILLANCE CAPSULE PROGRAM REPORT

SUMMARY OF FINDINGS (REACTOR VESSEL INTEGRITY NEUTRON IRRADIATION)

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

INTRODUCTION

By letter dated April 8, 2003, Wolf Creek Nuclear Operating Corporation (the licensee) submitted its report on reactor pressure vessel (RPV) surveillance Capsule X to NRC. Capsule X was withdrawn from the reactor pressure vessel of Wolf Creek Generating Station (WCGS) at the end of Refueling Outage No. 12. The submitted report is WCAP-16028, "Analysis of Capsule X from Wolf Creek Nuclear Operating Corporation, Wolf Creek Reactor Vessel Radiation Surveillance Program," Revision 0, dated March 2003.

The licensee stated that Capsule X reached the peak RPV surface fluence equivalent to 54 effective full power years (EFPY) after an actual exposure of 13.83 EFPY, since the lead factor (discussed below) for the capsule is 4.3. The capsule was withdrawn from the RPV on April 12, 2002.

The licensee has not requested and the staff, in reviewing WCAP-16028, Revision 0, is not approving, in any manner, any change to the licensing basis for WCGS.

REGULATORY REQUIREMENTS

Section IV of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50 requires that a report be submitted to the Nuclear Regulatory Commission for each capsule that is withdrawn from a RPV. The report is to be submitted within one year of the date of capsule withdrawal. The report must describe the capsule and the test results for the capsule.

SUMMARY OF STAFF'S FINDINGS

The staff's review of the report focused on three subjects: (1) to validate the licensee's fluence calculation, (2) to verify and compile the new and revised information on surveillance data in a format ready for updating the Reactor Vessel Integrity Database (RVID), and (3) to review or perform the chemistry factor calculation based on the added surveillance data to assess the adequacy of the current pressure-temperature limits, pressurized thermal shock (PTS) and upper shelf energy (USE) evaluation. The report for Capsule X was submitted by the licensee within one year of when the capsule was withdrawn from the RPV.

Surveillance Capsule X results are credible for use in calculating chemistry factors in accordance with Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials." Heat #90146 is applicable only to WCGS axial and circumferential welds.

Lead Factors and Capsule Fluence

Since last reported in 1995, the fluence calculation methodology has been changed. This results in a change to the capsule lead factors. Lead factors and capsule fluence reported in WCAP 16028, Revision 0, are different than originally reported in RVID.

Capsule	Capsule Location	Lead Factors		Capsule Fluence (10^{19}n/cm^2)	
		WCAP 16028	RVID	WCAP 16028	RVID
U	58.5^0 F	4.25	4.38	.316	.343
Y	241^0 F	3.93	4.00	1.19	1.308
V	60.1^0 F	4.02	4.08	2.22	2.528
X	238.5^0F	4.3	---	3.49	---

Note: WCAP-16028 updated lead factors and also provided plant-specific fluence evaluation based on Capsule X dosimetry analysis.

Chemistry Factors

Capsule X dosimetry analysis updated capsule fluence numbers for current capsule X and the previous capsules. This results in a change in chemistry factors.

Capsule Material	Chemistry Factor	
	WCAP 16028	RVID
Lower Shell Plate R2508-3	39.1	35.93
Weld (heat#90146)	44.1 (32.04)[a]	28.36

Note a: 32.04 is based on ratio of chemistry factors (vessel chemistry factor to capsule chemistry factor) of 0.726.

USE

USE values for lower shell plate (longitudinal and transverse) and circumferential weld (heat #90146) weld remain higher than 50 ft/lbs. USE for other beltline materials remain above 50 ft/lbs.

PTS

The reference temperature evaluated at the end-of-life fluence (RT_{PTS}) values for the WCGS vessel beltline materials remain below the screening criteria.

Pressure Temperature Operating Limits

Pressure temperature operating limits will not be significantly affected by the Capsule X results.

Fluence

Calculated neutron fluence (projected) (E >1.0 MeV) at the core midplane (clad/base metal interface) for 32 and 54 EFPY are: 2.03 $x10^{19}$ n/cm2 and 3.51 $X10^{19}$ n/cm^2, respectively.

Impact on Capsule X Results on RVID

The staff verified and compiled the new surveillance data for Capsule X and generated a table for RVID updating. The table is attached to this evaluation.

Attachment: Table 1

Principal Contributor: N. Ray

Date: January 21, 2004

TABLE 1

DOCUMENTATION AND EVALUATION OF ALL SURVEILLANCE DATA FROM WOLF CREEK GENERATING STATION

(REFERENCE: WCAP-16028, REVISION 0)

Material*	Capsule and lead factor	Fluence (10E19 n/cm^2)	FF (Fluence Factor)	ΔRT_{NDT} (°F) (a)	FF x ΔRT_{NDT}	FF ^{2}	Scatter/ ΔRT_{NDT} -CFxFF (°F) (b)	Credible?	USE (ft-lb)
Lower Shell Plate-L R2508-3	U,4.25	.316	.684	36.46	24.94	.468	9.72	Yes	145
	Y,3.93	1.19	1.05	16.03	16.83	1.1	-25.03	No	131
	V, 4.02	2.22	1.22	52.03	63.48	1.49	4.33	Yes	129
	X, 4.3	3.49	1.33	61.06	81.21	1.77	9.06	Yes	142
Lower Shell Plate-T R2508-3	U,4.25	.316	.684	23.79	16.27	.468	-2.95	Yes	96
	Y,3.93	1.19	1.05	35.39	37.16	1.1	-5.67	Yes	94
	V, 4.02	2.22	1.22	54.53	66.53	1.49	6.83	Yes	88
	X, 4.3	3.49	1.33	53.96	71.77	1.77	1.96	Yes	95
				Sum:	378.19	9.656			
	$CF_{R2508-3}$ =378.19/9.656=39.1 ^{0} F								
Surveillance Weld Material	U,4.25	.316	.684	27.21	18.612	.468	-2.95	Yes	92
	Y,3.93	1.19	1.05	45.09	47.34	1.1	-1.22	Yes	94
	V,4.02	2.22	1.22	46.3	56.49	1.49	-7.5	Yes	89
	X,4.3	3.49	1.33	68.36	90.92	1.77	9.71	Yes	93
				Sum:	213.362	4.828			
$CF_{Surv.\ Weld}$= 213.363/4.828=44.1 ^{0} F, Modified CF=32.04 ^{0}F(c)									

Notes:

a. ΔRT_{NDT} values are measured.

b. Predicted ΔRT_{NDT} is based on CF*FF. For example, CF for plate CF is 39.1 and ff is .684 and thus predicted ΔRTndt is 39.1*.684=26.74. Hence the scatter is 36.46-26.74=9.72.

c. CF for weld is 32.04°F considering the ratio of vessel chemistry factor to surveillance weld chemistry factor (44.1*31.6/43.5=32.04°F). Chemistry factors for capsule and vessel are taken from RVID.