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)
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	1 OF 0 5

TITLE (4) DAMAGE INCURRED IN HELIUM CIRCULATOR S/N C-2101 RESULTING IN EXCESSIVE SHAFT WOBBLE

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 8	2 7	8 7	8 7	0 1 9	0 0	0 9	2 6	8 7	N/A	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 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)	X 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)	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)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
Mark A. Joseph, Technical Services Supervisor	3 0 3 6 2 0 - 1 2 0 3

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	
X	A B	C M P	G 0 6 3	Y							

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 1	0 8	8 8

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

On July 22, 1987, "D" circulator (S/N C-2101) tripped on fixed high speed. Subsequent operation of the circulator revealed excessive shaft wobble. On July 31, it was decided to remove "D" circulator and replace it with a spare. Preliminary evaluations of the damaged circulator determined that this event has generic implications, which was identified to the NRC on August 27. A preliminary engineering report was prepared and is being submitted as part of this LER.

Although the root cause of the circulator failure has not been determined, preliminary metallurgical observations confirmed pre-existing cracks, likely due to stress corrosion cracking, in both the labyrinth seal mounting bolts, the steam ducting-to-bearing assembly bolts and the spring plunger.

The attached report provides justification for continued operation, assuming that the root cause is generic to all circulators. This justification is based on the fact that only one circulator is required to assure safe shutdown and Appendix R cooling, and that simultaneous loss of all four installed helium circulators is considered incredible.

Corrective actions include continued investigation of the failures observed on C-2101, and proposing a Tech. Spec. change to include an enhanced circulator in-service inspection program. These actions were summarized in letter P-87327 from PSC to NRC dated Sept. 21, 1987.

IE22

NR
198

1/1

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 7	— 0 1 9	— 0 0	0 2 OF 0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

EVENT DESCRIPTION:

Refer to Sections 2.0 through 4.0 of the attached "Preliminary Report of Helium Circulator S/N C-2101 Damage Including Licensing Assessment", pp. 1-25.

CAUSE DESCRIPTION:

The root cause of the circulator failure has not as yet been determined. Preliminary metallurgical observations have confirmed pre-existing cracks in both the labyrinth seal mounting bolts, the steam ducting-to-bearing assembly bolts and the spring plunger. The cracks are likely due to stress corrosion cracking (SCC), although no causative contaminant has been positively identified from the corrosion products available. Disassembly and thorough inspection of the remainder of the circulator is planned. Further evidence of a contaminant which may have led to the SCC will be sought.

SAFETY ANALYSIS:

Refer to Section 7.0 of the attached "Preliminary Report of Helium Circulator S/N C-2101 Damage Including Licensing Assessment", pp. 46-51.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 7	— 0 1 9	— 0 0	0 3 OF 0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

CORRECTIVE ACTION:

Corrective actions and operating restrictions were summarized in PSC letter P-87327 (R.O. Williams, Jr. to J.A. Calvo, dated September 21, 1987). These commitments are restated here in their entirety:

"Until PSC has completed its evaluation of the damage in circulator C-2101 and until the corrective actions have been implemented, PSC commits to restrict FSV operation as follows:

1. Prior to exceeding 30 percent power, PSC will have demonstrated that all four installed helium circulators can perform their required safety functions. Safe shutdown cooling capability of each circulator will have been demonstrated by restarting after a 90 minute shutdown and providing the equivalent of 3.8 percent primary coolant flow, while driving the Pelton wheels with simulated boosted firewater. (If the lower pressure unboosted condensate provides sufficient flow, this may be used to demonstrate boosted firewater capability.) Appendix R cooling capability will have been similarly demonstrated, using condensate Pelton wheel supply for Train A and simulated boosted firewater (or unboosted condensate) for Train B. Depressurized cooling capability will have been demonstrated by verifying shaft wobble less than an equivalent of 0.5 mils at 8000 rpm; since the lower pressure water turbine drive tests verify flow and speed characteristics, verifying the stability of the machine assures acceptable performance. The operability of helium circulator auxiliaries will be maintained per current Technical Specification requirements.

2. If another helium circulator is found to have failures similar to C-2101, the reactor will not be operated until corrective actions are completed.

3. PSC will not operate FSV at power levels above 35 percent unless all four circulators are operating. After a circulator trip, power will be reduced to less than 35 percent in an orderly manner, within 24 hours, until the reason for the circulator trip is determined, any corrective actions are completed, and the circulator is returned to operation.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 7	— 0 1 9	— 0 0	0 4 OF 0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

4. PSC will implement an enhanced monitoring program that will support circulator performance trend analysis. This program will monitor various performance indicators such as shaft wobble, bearing cartridge differential pressure, and self turbining capability. In the interim period until an improved wobble monitoring system is available, PSC will use oscilloscopes to monitor wobble daily or after unplanned speed changes. This interim wobble instrumentation is currently installed.

In addition to the above operating restrictions, PSC commits to the following actions:

1. PSC will continue to investigate the failures observed on circulator C-2101 and will provide a final engineering evaluation by January 8, 1988. This eva'uation will identify all corrective actions that PSC considers appropriate and will provide a plan and schedule for their implementation. A meeting with the NRC will be scheduled to discuss the proposed actions.

2. PSC will propose a change to Technical Specification SR 5.2.18, to include an enhanced circulator inservice inspection program. This program will be based on the results of the above engineering evaluation.

3. PSC will implement the corrective actions identified in the above engineering evaluation, on all circulators. Material replacements will be performed as soon as the materials and a refurbished spare circulator are available, approximately the spring of 1988. Other actions will be implemented in accordance with an agreed schedule."

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 7	— 0 1 9	— 0 0	0 5 OF 0 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Jeff Castor
Jeff Castor
Technical Services Engineer

Mark Joseph
Mark Joseph
Technical Services Supervisor

J. M. Grambling
Licensing

F. J. Novachek
Technical/Administrative Services Manager

★U.S.GPO:1986-0-624-538/455

ATTACHMENT TO P-87342