ENERGY NORTHWEST

P.O. Box 968 ■ Richland, Washington 99352-0968

April 17, 2003
GO2-03-064

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

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397**
LICENSEE EVENT REPORT NO. 2003-006-00

Dear Sir or Madam:

Transmitted herewith is Licensee Event Report No. 2003-006-00 for Columbia Generating Station. This report is submitted pursuant to 10 CFR 50.73(a)(2)(i)(A) and 10 CFR 50.73(a)(2)(i)(B). The enclosed report discusses items of reportability and corrective actions taken.

Should you have any questions or desire additional information regarding this matter, please call Ms. CL Perino at (509) 377-2075.

Respectfully,

RL Webring
Vice President, Nuclear Generation
Mail Drop PE04

Attachment

cc: EW Merschoff – NRC RIV
BJ Benney – NRC-NRR
INPO Records Center
NRC Sr. Resident Inspector – 988C (2)
RN Sherman – BPA/1399
TC Poindexter – Winston & Strawn
WB Jones – NRC RIV/fax

IE22

NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

Estimated burden per response to comply with this mandatory information collection request 50 hours Reported lessons learned are incorporated into the licensing process and fed back to industry Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U S Nuclear Regulatory Commission, Washington DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503 If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Columbia Generating Station	05000397	1 OF 4

TITLE (4)

Failure to Restore Emergency Diesel Generator Within TS Completion Time and Subsequent Plant Shutdown

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
02	16	2003	2003	006	00	04	17	2003	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)

	20 2201(b)		20 2203(a)(3)(ii)		50 73(a)(2)(ii)(B)		50 73(a)(2)(ix)(A)
	20 2201(d)		20 2203(a)(4)		50.73(a)(2)(iii)		50 73(a)(2)(x)
	20 2203 (a)(1)		50 36(c)(1)(i)(A)		50 73(a)(2)(iv)(A)		73 71(a)(4)
	20 2203(a)(2)(i)		50 36(c)(1)(ii)(A)		50 73(a)(2)(v)(A)		73.71(a)(5)
	20 2203(a)(2)(ii)		50 36(c)(2)		50 73(a)(2)(v)(B)		Other
	20.2203(a)(2)(iii)		50 46(a)(3)(ii)		50 73(a)(2)(v)(C)		Specify in Abstract below or in NRC Form 366A
	20 2203(a)(2)(iv)	x	50.73(a)(2)(i)(A)		50 73(a)(2)(v)(D)		
	20 2203(a)(2)(v)	x	50 73(a)(2)(i)(B)		50 73(a)(2)(vii)		
	20 2203(a)(2)(vi)		50 73(a)(2)(i)(C)		50 73(a)(2)(viii)(A)		
	20 2203(a)(3)(i)		50 73(a)(2)(ii)(A)		50 73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Christina Perino, Licensing Manager Columbia Generating Station	509 377-2075

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	EK	DG	S407	Y					

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 15 single-spaced typewritten lines) (16)

On February 13, 2003 with Columbia Generating Station (Columbia) operating in Mode 1 at 100% power, the Division 1 Emergency Diesel Generator (EDG-1) was declared inoperable at 2100 hours due to a lack of reasonable assurance of operability based on a degrading trend in the generator north bearing vibration levels. The amount of time required to correct this condition exceeded the 72 hour completion time requirements of Technical Specification (TS) 3.8.1, Condition B.4. Energy Northwest requested and received NRC enforcement discretion (NOED) from compliance with the completion time requirements of TS 3.8.1, Condition B.4, for 11 additional days. It was subsequently determined that both EDG-1 generator bearings required replacement. After the bearing replacement, vibration testing and analysis indicated the newly installed bearings were degrading. A failure analysis and a second replacement of the bearings could not be completed prior to the expiration of the NOED. Therefore, a reactor shutdown was commenced at 1945 on February 27, 2003 and Mode 4 was reached at 1721 on February 28, 2003. A root cause analysis concluded the cause of the degraded bearings was electrical arcing due to bearing electrical insulation system failure. Corrective actions include replacement of the bearings, restoration of the generator bearing electrical insulation system and improved methods of detecting the occurrence of electrical arcing in the generator bearings.

Event Description

On February 13, 2003 with Columbia Generating Station (Columbia) operating in Mode 1 at 100% power, the Division 1 Emergency Diesel Generator (EDG-1) was declared inoperable at 2100 hours due to a lack of reasonable assurance of operability based on a degrading trend in the generator north bearing vibration levels. Technical Specification (TS) 3.8.1, Condition B, was entered. The amount of time required to replace the bearing exceeded the 72 hour completion time requirements of TS 3.8.1, Condition B.4. No other inoperable equipment contributed to this event.

Energy Northwest requested and received enforcement discretion from compliance with the completion time requirements of TS 3.8.1, Condition B.4, for an additional 11-day period. The purpose of this enforcement discretion was to allow sufficient time to replace the generator bearings and restore EDG-1 to operable status.

During the activities to replace the generator north bearing it was determined that both EDG-1 generator bearings were damaged. After replacing both generator bearings and reassembling EDG-1, vibration testing and analysis indicated the newly installed bearings were degrading. Analysis of the bearing vibration data led to uncertainty regarding the ability of the new bearings to fulfill their design basis function of operating for at least 30 days after a design basis accident. Energy Northwest decided to disassemble the generator to determine the extent and cause of the bearing damage. Therefore, EDG-1 was not restored to operable within the time limit specified by the NOED and a plant shutdown commenced at 1945 hours on February 27, 2003. On February 28, 2003 the plant entered Mode 3 at 0449 hours and Mode 4 at 1721 hours. No other inoperable equipment contributed to this event.

A four hour event notification telephone call was made to the NRC Operations Center at 2337 EST on February 27, 2003 pursuant to 10 CFR 50.72(b)(2)(i) after the plant shutdown was initiated (Event Number 39625).

There were no failures of significant plant equipment during the shutdown. The shutdown was uneventful with the exception of receiving Oscillation Power Range Monitor alarms when in the area of increased awareness and a preheater steam supply valve failed to close. Alternate means to detect and suppress thermal hydraulic instability oscillations confirmed no instability was present. The preheater steam supply valve was manually closed by an operator. There were no adverse consequences to other plant equipment or to the health and safety of the public as a result of this required shutdown.

Following the plant shutdown, the generator bearings were replaced a second time and followed by post-maintenance testing.

Cause of the Event

A formal root cause analysis concluded the initial cause of the degraded bearings was electrical arcing damage due to a breach located somewhere in the south end bearing insulation system. However, the source of the initial insulation breach could not be determined.

A bearing failure analysis determined fluting existed in both the north and the south bearings of the generator. Fluting is a type of metal pitting damage that resembles a repeating pattern of long axial grooves in a stripe-like appearance. The fluting was caused by electrical arcing damage. Electrical arcing damage occurs in a bearing when a path exists for shaft circulating currents to pass through the bearings due to a breach in the bearing's electrical insulation system.

The bearing failure analysis also concluded that there was spallation on the outer race of the south bearing. This spallation was attributable to a combination of electrical arcing damage, bearing race material (thru-hardened martensitic steel vs. case hardened carburized steel) and misalignment wear. The cause of the misalignment wear is suspected to be due to a minor misalignment of the bearing housing to the bearing pedestal that was introduced during generator reassembly in 1991.

The cause of the bearing failures following replacement was determined to be an incorrectly sized insulated dowel pin used during reassembly which resulted in a breach of the bearing electrical insulation system. The organizational behaviors that contributed to the dowel pin modification will be reviewed further for possible improvements and additional corrective actions will be performed if needed. The primary barrier that failed to prevent damaging the new bearings was the lack of detection of a rotor shaft circulating current which was inadvertently introduced by the dowel pin. If the current flowing through the new bearings had been detected, then it is possible the integrity of the electrical insulation could have been restored before bearing damage occurred.

Contributing causes include weaknesses in the Vibration Monitoring Program and the Oil Analysis Program. These programs were not robust enough to detect the actual cause of the north bearing degradation, or the fact the south bearing was also degraded.

Safety Significance

EDG-1 is a 4400 KW generator mounted between tandem V-20 cylinder diesels. It supplies the Division 1 safety related bus in the event that normal and backup power supplies are lost. With one EDG inoperable, the remaining operable EDG's and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component bases, single failure protection of the required feature's function may have been lost; however, the safety support function was not lost. An identical diesel generator system is installed to support the Division 2 safety related bus. Verification was made that the same failure mechanism did not exist on the Division 2 and Division 3 (HPCS) EDGs. The basis for requesting the NOED included establishing compensatory measures sufficient to assure the plant risk remained low. There were no safety consequences associated with this event and the risk significance of the event was minimized by preplanned compensatory measures.

This event was considered reportable in accordance with 10 CFR 50.73(a)(2)(i)(A) and 10 CFR 50.73(a)(2)(i)(B).

Corrective Actions

Corrective actions were taken to replace the degraded bearings, assure the integrity of the electrical insulation system, and verify bearing to shaft alignment.

Corrective Actions to Prevent Recurrence

Additional corrective actions are planned to enhance Columbia's ability to detect and diagnose electrical arcing damage at the onset prior to bearing degradation. This includes improving the Vibration Monitoring Program, Oil Analysis Program, and insulation integrity testing frequency and methodology.

Previous Similar Events

The two previous events involving EDG bearing failures that occurred at Columbia are listed below.

Past Similar Event: LER 90-012
Event Date: 5/27/1990
Failed Component: Division 1 EDG generator bearing failure due to improper lubrication
Manufacturer: S407
Model: L-11011

Past Similar Event: LER 91-006
Event Date: 4/12/1991
Failed Component: Division 1 EDG generator bearing degradation due to contaminated oil
Manufacturer: S407
Model: L-11011

The previous similar events listed above involved bearing degradation but neither event was caused by electrical arcing damage. Therefore, due to the significant difference in the causes of these events, the actions to prevent recurrence for these past events would not have been effective in precluding the bearing degradation that was experienced due to a breach in the bearing electrical insulation system.