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GO2-11-035

10 CFR 50.73

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

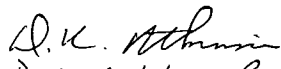
Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397**
LICENSEE EVENT REPORT NO. 2010-002-00

Dear Sir or Madam:

Transmitted herewith is Licensee Event Report No. 2010-002-00 for Columbia Generating Station. This report is submitted pursuant to 10 CFR 50.73(a)(2)(v)(D). The enclosed report discusses items of reportability and corrective actions taken related to the low pressure core spray minimum flow valve failure to open due to premature fuse failure at the solder joint. This discrepant condition was discovered on December 20, 2010.

There are no commitments being made to the NRC herein. If you have any questions or require additional information, please contact Mr. K. D. Christianson at (509) 377-4315.

Respectfully,


D.K. Atkinson for
B. J. Sawatzke

Vice President, Nuclear Generation & Chief Nuclear Officer

Enclosure: Licensee Event Report 2010-002-00

cc: NRC Region IV Administrator
NRC NRR Project Manager
NRC Senior Resident Inspector/988C
R.N. Sherman – BPA/1399
W.A. Horin – Winston & Strawn
INPO Records Center

IE22
NRC

LICENSEE EVENT REPORT (LER)
(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@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 an 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.

1. FACILITY NAME

Columbia Generating Station

2. DOCKET NUMBER

05000 397

3. PAGE

1 OF 4

4. TITLE

LPCS minimum flow valve failed to open due to premature fuse failure at the solder joint

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	20	2010	2010	- 2 -	0	02	18	2011	FACILITY NAME	05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

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

- | | | | |
|---|---|---|--|
| <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | <input type="checkbox"/> 50.73(a)(2)(i)(C) | <input type="checkbox"/> 50.73(a)(2)(vii) |
| <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |
| <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | <input type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) |
| <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix)(A) |
| <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x) |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | <input type="checkbox"/> 50.73(a)(2)(v)(A) | <input type="checkbox"/> 73.71(a)(4) |
| <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(v)(B) | <input type="checkbox"/> 73.71(a)(5) |
| <input type="checkbox"/> 20.2203(a)(2)(v) | <input type="checkbox"/> 50.73(a)(2)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(v)(C) | <input type="checkbox"/> OTHER |
| <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D) | Specify in Abstract below
or in NRC Form 366A |

10. POWER LEVEL

100

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

Lisa L Williams - Principal Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(509) 377-8148

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	BM	FU	B569	Y					

14. SUPPLEMENTAL REPORT EXPECTED☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

This event is being reported under 10 CFR 50.73(a)(2)(v)(D). On December 20, 2010, the low pressure core spray pump was started and the minimum flow valve lost indication. An annunciator was received indicating that the valve had lost power. The three line power fuses for the starter for the motor operator were found to be cleared. The cleared fuses were Cooper/Bussman Fusetron dual-element, time-delay, current-limiting, 600 Volt, 1.25 Amp fuses (model FRS-R-1-1/4). The overload element in each fuse was failed (triggered). Troubleshooting did not reveal any binding within the valve, binding within the motor operator, or sticking or dirty contacts within the starter. An examination of the cleared fuses revealed a poor solder joint in the trigger assembly in one fuse. The cause of this event is premature failure of one of the three fuses from momentary inrush current at a current value under the fuse curve which led to overload and failure of the remaining two fuses. Corrective actions consisted of quarantine of fuses from the same lot as that of the cleared fuses and inspection of fuses in all safety-related motor operated valves in support of ECCS to ensure they were not the same brand fuse of the same 1.25 Amp size from the same lot.

**LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION
CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Columbia Generating Station	05000 397	YEAR	SEQUENTIAL NUMBER	REV NO.	2 OF 4
		2010	- 002	- 00	

NARRATIVE

Plant Condition

The plant was operating in Mode 1 at 100% power. All trains of the low pressure coolant injection (LPCI) system [BO], high pressure core spray (HPCS) system [BG], and standby service water (SSW) system [KE] were operable at the time of the event.

Maintenance on the low pressure core spray (LPCS) [BM] water leg pump (LPCS-P-2) [P] was scheduled for December 20, 2010. In preparation for the water leg pump being out of service, the LPCS system was planned to be aligned to the suppression pool with the LPCS pump (LPCS-P-1) in operation to maintain pump discharge pressure. The procedure for aligning the LPCS system to the suppression pool requires declaring LPCS inoperable. LPCS was declared inoperable on December 20, 2010 at 0435 hours.

There were no structures, systems, or components that were both a) inoperable at the time of the event and b) contributed to the event.

Event Description

Subsequent to declaring LPCS inoperable in preparation for alignment to the suppression pool, LPCS-P-1 was started at 0437 hours. The minimum flow valve (LPCS-FCV-11) [FCV] for LPCS-P-1 lost indication when the valve was expected to open. In addition, annunciation for "LPCS OUT OF SERVICE" and "MOV NETWORK PWR LOSS/OL" was received indicating that LPCS-FCV-11 had lost power. LPCS-P-1 was secured at 0438 hours and LPCS-FCV-11 was declared inoperable. LPCS-FCV-11 functions as a primary containment isolation valve (PCIV) and the Technical Specification (TS) Required Action for Limiting Condition for Operation (LCO) 3.6.1.3 Condition C, one or more penetration flow paths with one PCIV inoperable, was complied with by isolating the affected penetration flow path by closing the LPCS minimum flow isolation valve (LPCS-V-52). In addition, PCIVs are required to have operable position indication in accordance with TS Table 3.3.3.1-1 Function 7. The TS Required Action for LCO 3.3.3.1 Condition A, one or more functions with one required channel inoperable, was complied with by closing LPCS-V-52 within the required completion time.

An investigation was initiated to determine the cause of the loss of power to the valve. The three line power fuses [FU] for the reversing starter [MSTR] for the minimum flow valve motor operator were found to be cleared. The circuit was meggered satisfactorily indicating that a short-circuit condition did not exist. The valve was manually unseated to allow it to be stroked for measurements of starting and running motor current amps. The fuses were replaced and the valve stroked open and closed normally; the fuses did not clear.

At the conclusion of the troubleshooting activities, the valve stroke time surveillance was completed satisfactory at 2300 hours and the valve was declared operable. The surveillance establishing LPCS operability was completed on December 21, 2010 at 0024 hours and LCPS was declared operable. The elapsed time from the occurrence of the event until LPCS was returned to service was 19 hours 49 minutes.

LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Columbia Generating Station	05000 397	YEAR	SEQUENTIAL NUMBER	REV NO.	3 OF 4
		2010	- 002	- 00	

NARRATIVE

Immediate Corrective Actions

Immediate corrective actions consisted of protecting the alternate sources of emergency core cooling system (ECCS) injection/spray including residual heat removal (RHR), which performs the LPCI function, and HPCS. The supporting systems of SSW and the diesel generators [EK] were also protected.

Assessment of Safety Consequences

The safety functions for LPCS are to provide inventory makeup and spray cooling during large breaks in the reactor coolant system that uncover the core. All remaining ECCS subsystems were operable and at no time did this event result in the loss of a safety function. The low pressure injection function was not challenged due to all three loops of RHR system LPCI mode being operable while the core spray function was satisfied by the operable HPCS system.

This event did not pose a threat to the health and safety of the public. The TS Required Action for LCO 3.5.1 Condition A, one low pressure ECCS injection/spray subsystem inoperable, was complied with by restoring the LPCS system to operable within the allowed completion time. In addition, the TS Required Actions for LCO 3.6.1.3 Condition C and LCO 3.3.3.1 Condition A were completed within the required completion time. Thus, Columbia Generating Station was never in a condition prohibited by TS.

This event is being reported under 10 CFR 50.73(a)(2)(v)(D) as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident for a single train system. The minimum flow valve supports LPCS operability by providing a flow path to prevent pump damage during situations where the LPCS pump has been started in response to a transient but reactor vessel pressure is not low enough to allow LPCS injection.

Historically, when LPCS has been inoperable at Columbia Generating Station, it was not considered to be reportable as a single train system. This treatment is consistent with the plant safety analysis and the associated system and safety function groupings which do not identify LPCS as a single train system. There are two pertinent groupings in the safety analyses which are aligned with the credited safety functions of LPCS. The two groupings are the low pressure injection system function (combined with LPCI), and a core spray system function (combined with HPCS). Industry precedent has been consistent with the historical position. However, recent NRC interpretations have considered safety function at the lowest system level, which results in LPCS being considered a single train performing a safety function.

Causes

The direct cause of LPCS-FCV-11 failing to open as expected was a loss of power that occurred when the overload elements cleared within the three line power fuses. Possible reasons to fail or trigger the overload elements in the fuses are binding within the flow control valve, binding within the motor operator, sticking or dirty contacts within the reversing starter, or a premature failure of a fuse. Once the fuses were replaced, normal operation was restored with no observed binding of the valve or motor operator or abnormalities with the reversing starter. Diagnostic testing of the motor operator was completed which showed that the amps drawn by the motor were under the fuse manufacturer's time-current curve.

**LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION
CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Columbia Generating Station	05000 397	YEAR	SEQUENTIAL NUMBER	REV NO.	4 OF 4
		2010	- 002	- 00	

NARRATIVE

The failed fuses had been installed approximately two years ago but were 12 years old. An examination of the three failed fuses revealed a poor solder joint in the trigger assembly in one of the failed fuses. The apparent cause of this event is attributed to premature failure of one of the three installed power line fuses from momentary inrush current at a current value under the fuse curve. This conclusion is based on the examination of the fuse trigger solder which displayed evidence of cold unattached solder and trapped resin flux in the trigger solder joint. Also, no heating damage of the PET (polyethylene terephthalate) insulating spool was observed. Two of the fuses obviously failed from current overload on the resulting failure of the first fuse. These two fuses were determined to have functioned normally.

Initially, this event was considered to be not reportable until discussions were held with the NRC Resident Inspector and Regional staff. Upon determination of reportability of this event, a prompt notification was made to the NRC in accordance with 10 CFR 50.72(b)(3)(v)(D) via Event Notification #46604. As such, the event investigation was conducted as an apparent cause rather than a root cause evaluation. A root cause analysis is in progress but has not yet been completed for this event. If new information is gained, which invalidates the stated cause or corrective actions, this report will be revised to incorporate the new information.

Further Corrective Actions

The fuses that failed were Cooper/Bussmann Fusetron dual-element, time-delay, current limiting, 600 Volt, 1.25 Amp fuses (model FRS-R-1-1/4). Since the fuse overload element was found to be triggered, the operating history of the LPCS-FCV-11 motor operator and starter was investigated: 1) In March 2008, a diagnostic test of the motor operator was completed satisfactorily with no abnormalities noted. 2) In March 2009, an inspection of the reversing starter was completed satisfactorily. The fuses were replaced at this time. 3) In April 2010, the motor operator was lubed and inspected with no problems found. 4) The last quarterly LPCS surveillance test prior to the event was completed satisfactorily on September 29, 2010.

Warehouse and tool crib stock of the Bussmann FRS-R-1-1/4 fuses from the same G10 date code lot as that of the three failed fuses were quarantined and segregated to prevent further installation of suspect fuses. This lot of fuses was received at Columbia Generating Station in 2000. Enhancements to the Bussmann fuse dedication process to require additional receipt inspections and testing are planned.

A search was performed of all safety-related ECCS motor operated valves which may possibly contain the same Bussmann 1.25 Amp fuses from the same lot. Inspections were performed and no additional fuses of the same lot were found to be installed.

Similar Events

No similar events have been reported by Columbia Generating Station.