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August 22, 2005
GO2-05-146

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. 2005-004-00

Dear Sir or Madam:

Transmitted herewith is Licensee Event Report No. 2005-004-00 for the Columbia Generating Station. This report is submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A), 10 CFR 50.73(a)(2)(v)(D), and 10 CFR 50.73(a)(2)(i)(B). The enclosed report discusses items of reportability and corrective actions taken.

If you have any questions or require additional information, please contact Mr. GV Cullen at (509) 377-6105.

Respectfully,

WS Oxenford
Vice President, Technical Services
Mail Drop PE04

Enclosure: Licensee Event Report 2005-004-00

cc: BS Mallett – NRC RIV
BJ Benney – NRC NRR
INPO Records Center
NRC Sr. Resident Inspector – 988C (2)
RN Sherman – BPA/1399
WA Horin – Winston & Strawn
CE Johnson – NRC RIV/fax

IE22

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Columbia Generating Station	05000397	1 OF 5

4. TITLE
Reactor Scram During Plant Startup Due to Reactor Feedwater Pump Trip

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 05000
06	23	2005	2005	004	00	08	22	2005	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE: 1

10. POWER LEVEL: 023

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

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203 (a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	☐ Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Craig Sly, Principal Engineer - Licensing	509-377-8616

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

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

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

On June 23, 2005, Columbia Generating Station was in Mode 1 with the reactor operating at approximately 23 percent power. At 13:46 PDT, an automatic reactor scram occurred due to a low water level condition in the reactor vessel. The low reactor water level condition was caused by an inadvertent loss of reactor feedwater pump RFW-P-1B due to a false low suction pressure signal caused by human error during planned maintenance activities. Control room operators entered appropriate Emergency Operating Procedures and stabilized the plant following the reactor scram. Plant systems responded as designed with the exception of RCIC as discussed below. As long term corrective action, a time delay will be installed or the low suction pressure trip removed to prevent spurious RFW pump trips.

The RCIC system was manually started to restore reactor water level and was later manually tripped. The system had to be reset locally due to tripped mechanical overspeed trip linkage. During two subsequent attempts to restart RCIC the pump tripped on low suction pressure. Operators were then able to successfully start RCIC with the flow controller in manual. A time delay has been added to the RCIC low suction pressure trip logic to resolve this issue.

17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

PLANT CONDITIONS

The plant was operating in Mode 1 at approximately 23 percent power at the time of this event.

EVENT DESCRIPTION

On June 23, 2005, Columbia Generating Station was in Mode 1 with the reactor operating at approximately 23 percent power. At 13:46 PDT, an automatic reactor scram occurred due to a low water level condition in the reactor vessel. The low reactor water level condition was caused by an inadvertent loss of reactor feedwater [SJ] pump [P] RFW-P-1B due to a false low suction pressure signal inadvertently generated during planned maintenance activities.

The Control Room Supervisor (CRS) entered Emergency Operating Procedure PPM 5.1.1, RPV Control. Water level continued to decrease during an attempt to bring the standby RFW-P-1A up to speed. The lowest reactor water level attained was -48 inches. A reactor vessel level 2 (reactor water level less than -50 inches) isolation signal was obtained which caused primary containment isolation valves [ISV] to close, including the Main Steam Isolation Valves (MSIVs), and standby gas treatment systems [BH] to start. However, no level 2 Emergency Core Cooling System (ECCS) actuations occurred due to differences in instrumentation setpoint tolerances and the fact that an actual level 2 was not achieved.

At about 13:50 the reactor core isolation cooling (RCIC) system [BN] was manually started using the initiation push button and utilized to restore reactor water level. At about 14:14 after level had been restored, RCIC was manually tripped. The control room operator was unable to reset the RCIC system from the control room. An operator was dispatched to investigate and found the mechanical over-speed trip linkage was not properly positioned. The operator re-positioned the trip linkage and at about 14:45 the steam inlet valve trip signal was reset.

At about 15:32, a manual start of the RCIC pump was attempted from the control room using the initiation push button. The pump ramped up properly, and then tripped at maximum flow. A second attempt using the initiation push button was made at about 15:39 and the pump again tripped. At about 15:49 a third attempt was made to start RCIC. This time the attempt was made with the flow controller in manual. After starting the pump, flow was increased in a controlled manner and the system ran for an extended period with no subsequent unanticipated trips.

At about 15:50 the NRC was notified of the RPS actuation per 10 CFR 50.72(b)(2)(iv)(B) and 10 CFR 50.72(b)(3)(iv)(A) (reference event notification number 41790). This LER is submitted pursuant to 50.73(a)(2)(iv)(A) as an event or condition that resulted in manual or automatic actuation of the reactor protection system [JC]. In addition, historical time periods where conditions existed similar to those that led to the failure of RCIC to operate properly following the scram are being reported pursuant to 50.73(a)(2)(v)(D) as a condition that could have prevented fulfillment of a safety function, and 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications.

IMMEDIATE CORRECTIVE ACTIONS

Following the event, plant personnel performed an investigation into the cause of the scram and determined that it was caused by human error during performance of a maintenance activity. Immediate actions taken included a stand-down with Maintenance and Operations supervision, management readiness reviews of all routine and emergent work, and additional oversight of all control room and selected field activities. The readiness reviews and additional oversight were terminated following plant restart.

Plant personnel also performed an investigation into the cause of the RCIC trips and found that the system was tripping on low suction pressure due to short term pressure drops during pump starts under certain conditions. The relays associated with the RCIC low suction pressure trip were replaced with time delay relays. This will prevent future RCIC trips due to short duration low suction pressure conditions. These changes were made and the system restored to operable status prior to the plant exceeding 150 psig as required by Technical Specifications.

CAUSE OF EVENT

The physical cause of the reactor scram was a loss of feedwater to the reactor vessel. The loss of feedwater was caused by a false low suction pressure signal input to RFW-P-1B. The false low suction pressure signal was generated when an electrician briefly connected a multi-meter, set to measure Ohms, across two termination points, introducing a voltage which resulted in a rapidly reduced feed flow rate. The electrician was removing a bypass of the low suction pressure trip logic using an approved procedure, but did not have a full understanding of the configuration he was restoring, and connected across the wrong termination points. The bypass had been installed to avoid a potential inadvertent trip of the feed pumps during feedwater heater restoration following replacement of three condensate system relief valves that had lifted during plant startup evolutions.

A root cause analysis has been completed regarding this event. The three primary causes are summarized as follows:

1. The feedwater system is susceptible to spurious pump trips due to system design. Many BWRs have installed a time delay on the feedwater pump low suction pressure trip and staggered the feedwater pump low suction pressure trip set points or respective time delays. Energy Northwest has not yet installed this modification. Implementation of this modification would have precluded the need to bypass the low suction pressure trips during the replacement of the relief valves.

2. Previous corrective actions to address condensate system [SD] relief valve [RV] failures did not

adequately address prevention of future relief valve failures. Lifting of condensate system relief valves during startup, requiring maintenance activities and tag-out and restoration of the heaters, has been a recurring issue at Columbia.

3. Failure to recognize and mitigate risks associated with the low suction pressure trip bypass activities due to inadequate engagement of personnel in ownership of the evolution. This evolution had several human performance aspects that contributed to the event.

The RCIC system unanticipated trips were determined to have been caused by a short duration low suction pressure condition due to system design. This short duration low suction pressure condition occurred after the pump started, just as the pump discharge pressure exceeded reactor vessel pressure and started to deliver flow into the reactor vessel. As the RCIC discharge check valves rapidly open, a short duration negative pressure spike is experienced throughout the system. Normally, the suction pressure of RCIC is maintained at a high enough value, due to RCIC keepfill pump operation, that this negative pressure spike does not actuate the low suction pressure switch. However, shortly after the RCIC pump is shut down following operation, the suction pressure is lower if the keepfill pump has not operated and this short duration negative pressure spike can actuate the low suction pressure trip circuit and cause the pump to trip.

A review of operating history was performed and found that there were several time periods where RCIC had operated and been secured, but the keepfill pump had not operated and pressurized the suction piping. During those time periods it is possible that the pump would have experienced a low suction pressure trip if called upon to perform its function following a Control Rod Drop Accident. Final cause investigation is not complete for this issue. A supplemental LER will be issued following completion of this investigation if further information of significance warrants a supplement.

FURTHER CORRECTIVE ACTIONS

A corrective action plan has been established to correct the causes associated with the reactor scram.

1. A modification to install a time delay on the feedwater pump low suction pressure trip and stagger the feedwater pump low suction pressure trip set points or respective time delays or to remove the low suction pressure trips will be implemented.

2. A separate root cause evaluation will be performed for failures of condensate system relief valves and will identify actions to address these issues.

3. A tool has been developed that will help establish and promote behaviors of exemplary activity ownership and includes a process for error reviews that clearly outlines personal responsibilities and expected accountability regarding plant evolutions. Energy Northwest will communicate this tool to station personnel and will train managers and supervisors on the process. A means to allow

management to be aware of and monitor the routine use of this tool and communicate results will also be created and implemented.

A final cause analysis has been initiated regarding the RCIC unanticipated trips that occurred but has not been completed. Appropriate further corrective actions will be implemented based on the results of this analysis. A supplemental LER will be issued if this cause analysis uncovers information of significance that warrants a supplement.

ASSESSMENT OF SAFETY CONSEQUENCES

This event posed no threat to the health and safety of the public or plant personnel. A loss of feedwater is an anticipated transient and the plant responded as designed with the exception of RCIC as discussed below. The minimum indicated RPV level attained was -48 inches. Operators successfully started RCIC for RPV level control. After securing RCIC, operators were not able to restart RCIC on two attempts when a trip signal occurred. Operators were subsequently able to restart RCIC. All other safety equipment was available during this transient and performed as expected. There were no structures, components, or systems that were inoperable at the start of the event and contributed to the event. The plant was stabilized in Mode 3 without further complication.

If operators had not been able to restore RCIC operation, the High Pressure Core Spray (HPCS) system was available to provide inventory makeup. In addition, plant conditions were such that operators could have re-opened the MSIVs and restored RFW or Condensate Booster Pump operation.

SIMILAR EVENTS

Energy Northwest previously reported a similar event involving a reactor scram associated with a feedwater transient (LER 2004-06-00). In that event a licensed control room operator improperly filled a feedwater heater [HX] with condensate following maintenance. This improper filling evolution tripped the only running reactor feedwater pump initiating a loss of feedwater transient. The reactor was scrammed manually prior to level reaching the automatic trip set point. The event documented in LER 2004-06-00 is similar to the current event in that both occurred during performance of recovery efforts following maintenance on condensate system relief valves that had lifted during plant startup evolutions. However, they are different in the human performance aspects. Corrective actions taken to address the previous event were effective in that the filling of the feedwater heater following maintenance was performed successfully during the evolution discussed in this LER.