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Steven Vercelli
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10 CFR 50.73

RBG-47926

January 9, 2019

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

Subject: Licensee Event Report 50-458 / 2018-010-00, "Reactor Scram due to Turbine Control Valve Failure".
River Bend Station, Unit 1
NRC Docket No. 50-458
Facility Operating License No. NPF-47

Dear Sir or Madam:

In accordance with 10 CFR 50.73, enclosed is the subject Licensee Event Report. This document contains no commitments. If you have any questions, please contact Mr. Tim Schenk at 225-381-4177.

Sincerely,

Steven P Vercelli

SV/twf

Enclosure: Licensee Event Report 50-458 / 2018-010-00, "Reactor Scram due to Turbine Control Valve Failure".

cc: NRC Region IV Regional Administrator, w/o Enclosure
NRC Senior Resident Inspector – River Bend Station, Unit 1
Ji Young Wiley, Department of Environmental Quality, Office of Environmental Compliance, Radiological Emergency Planning and Response Section
Public Utility Commission of Texas, Attn: PUC Filing Clerk
NRC Project Manager

NRC FORM 366
(04-2018)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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	2. Docket Number	3. Page
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4. Title

Reactor Scram due to Turbine Control Valve Failure

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
									NA	05000 NA
11	10	2018	2018	- 010	- 00	01	09	2019	Facility Name NA	Docket Number 05000 NA

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☑ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. Power Level	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
100	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ Other (Specify in Abstract below or in NRC Form 366A)	

12. Licensee Contact for this LER

Licensee Contact	Telephone Number (Include Area Code)
Tim Schenk, Manager - Regulatory Assurance	225-381-4177

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to ICES	Cause	System	Component	Manufacturer	Reportable to ICES
E	JI	SCV	G080	Y	D	JI	SCV	G080	Y

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
☐ Yes (If yes, complete 15. Expected Submission Date) ☑ No		NA	NA	NA

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

On November 10, 2018 at 00:46, with the reactor operating at 100% power, Turbine Control Valve number 3 (CV3) unexpectedly closed. Turbine Control Valve number 4 (CV4) did not respond as designed and the reactor automatically scrammed on a reactor vessel high pressure signal. Following the scram, all major systems responded as designed. The CV3 closure was due to failure of the valve's push rod spring housing coupling bolts. The CV4 failure to correctly respond to the CV3 closure transient was due to incorrect operating procedure guidance. This event was of minimal significance to the health and safety of the public.

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(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

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		YEAR	SEQUENTIAL NUMBER	REV NO.
River Bend Station - Unit 1	05000- 458	2018	- 010	- 00

NARRATIVE

BACKGROUND

Steam is delivered to the High Pressure (HP) turbine (**TRB**) through the Main Stop Valves (MSVs) (**SHV**) and the Turbine Control Valves (CVs) (**SCV**). There are four MSVs that shut off steam to the turbine under trip conditions. The four CVs are used to control the load on the turbine. The exhaust from the HP turbine is sent to the Moisture Separator/Reheaters (MSRs) (**MSR**) to improve the quality of the steam prior to being delivered to the Low Pressure (LP) turbines. Steam leaving the MSRs flows into the LP turbines through the four Combined Intermediate Valves (CIVs). Each CIV is made up of two valves, an Intermediate Stop Valve (ISV) and an Intercept Valve (IV).

The Electro-Hydraulic Control (EHC) [JI] System controls the position of large steam valves by means of electrical signals that change the hydraulic fluid flows of the positioning components of the valves. The EHC System is controlled by inputs from Ovation software using a valve positioner module. The modulating valves controlled by the EHC System are MSV2, IV1, IV2 and the four CVs.

The EHC load limit function bounds the steady state open position of the CVs to limit the flow of steam to the turbine. Operators manually enter the desired load limit value from an EHC system graphic display interface.

During normal plant operation at 100% power, three CVs are full open and one is approximately 30% open. If one of the full open CVs should unexpectedly close, the Turbine Bypass Valves and partially closed CV will open to control reactor vessel pressure.

The CV operating mechanism utilizes a spring assembly which acts directly on the valve stem to hold the valve closed. The valve is then mechanically opened by a hydraulic cylinder which lifts the end of a lever with a push rod. Spring force opposes the hydraulic force on the push rod. The springs are compressed as the hydraulic pressure pushes the push rod up to open the valve, thus increasing the compressive force exerted by the springs.

The push rod spring housing coupling joint consists of two rigid members held together by 20 bolts. One of the rigid members in the push rod spring housing coupling is the switch arm.

REPORTED CONDITION

On November 10, 2018, the reactor was operating at 100% power with CV1, CV2, and CV3 full open and CV4 27% open. At 00:46 CV3 unexpectedly closed. Both Main Turbine Bypass Valves fully opened as designed. CV4 did not open as designed which resulted in an automatic reactor scram on high reactor vessel pressure. There were no maintenance activities being performed on the EHC System or CVs prior to or during the event.

PREVIOUS OCCURRENCE EVALUATION

On April 23, 2012, CV3 unexpectedly closed. The other three CVs and Turbine Bypass Valves responded as designed. Operators stabilized the plant and a planned outage was later executed to repair CV3. The cause of the CV closure was determined to be failure of the push rod spring housing coupling bolts. One of the root cause evaluation failure analysis recommendations was to ensure that the bearing surface is flat with a slope of less than 1:20 as recommended by the

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Research Council on Structural Connections. There is no documentation that this recommendation was ever satisfied.

CAUSAL ANALYSIS

Turbine Control Valve Number Three Unexpected Closure

The unexpected closure of CV3 on November 10, 2018 was determined to be due to failure of all 20 of the push rod spring housing coupling bolts.

The Research Council on Structural Connections recommends the bearing surface of the CV3 push rod spring housing joint to be flat with a slope of less than 1:20. There was no record found of the push rod spring housing joint flatness at the time of assembly in 2012. During the Digital EHC upgrade in March 2017, the switch arm, which is part of the push rod spring housing joint bearing surface, was found to be bent. The 2017 evaluation of this condition assumed that the joint bearing surface was not affected by the bent switch arm and the CV3 repair was scheduled for a planned outage in March of 2019. Preliminary measurements of the CV3 switch arm after the November 2018 event indicated that the bearing surface was over 0.0625 inches out of flat at some of the bolt locations and therefore did not meet the Research Council on Structural Connections recommendation. The out of flat condition on the joint bearing surface amplified the stress on the push rod spring housing coupling bolts causing them to fail.

The cause of the bent switch arm is not readily apparent. There are no physical interferences that could cause the deformation that was identified on the switch arm.

Transient Response of Turbine Control Valve Number Four

The failure of CV4 to respond to the CV3 closure transient as designed was determined to be due to incorrect procedural guidance.

A review of Ovation parameter settings discovered that the CV4 load limit was set at 100%, rather than the correct value of 103%. The operating procedure used to enter the load limit value called for a load limit value of 100% instead of the correct value of 103%. This error was traced back to procedure revisions performed as part of the Ovation Digital EHC upgrade in March of 2017.

With the load limit incorrectly set, CV4 stroke was limited to between 44% and 70% open. With a load limit set at 103% CV4 would be able to stroke to the full open position during a single CV closure.

CORRECTIVE ACTION TO PREVENT RECURRENCE

The following actions have been completed to prevent recurrence.

-Inspect all CV bolting for loose or broken switch arm bolts.
-Review Ovation data for all CVs and CIVs to confirm hydraulic functionality.
-Inspect all other CV switch arms for flatness and broken switch arm bolts.

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-Review Ovation data for all CVs and CIVs for symptoms of a bent switch arm or broken bolts.
-Review Digital EHC procedures that change load limit for correct values.
-Update operating procedures to include the correct load limit values.

The following actions have been assigned to prevent a recurrence of this event and are documented in the station corrective action program.

-Visual inspection of CIV bolting shall be performed during the next refueling outage to confirm no bolts are broken.
-Visual inspection of CIV switch arm shall be performed during next refueling outage to confirm no deformation.
-Develop a preventive maintenance strategy for CV and CIV switch arm and bolting inspections. Inspections should include bolt tightness verifications and ensure that the bearing surface is flat with a slope of less than 1:20.
-Review all Digital EHC procedures and verify that all manually entered Ovation parameters are correct and consistent with their basis.
-Develop a preventive maintenance strategy for Ovation parameter verification as part of the startup procedure.

SAFETY SIGNIFICANCE

The unexpected closure of CV3 and subsequent reactor scram are bounded by transient analysis contained in the Updated Safety Analysis Report. Following the reactor scram, all major systems performed as designed. No safety injection systems were actuated either manually or automatically as a result of the event. Therefore this event is considered to be of minimal significance to the health and safety of the public.

(NOTE: Energy Industry Identification System component function identifier and system name of each component or system referred to in the LER are annotated as (**XX**) and [XX], respectively.)