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Brian R. Sullivan
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JAFP-15-0083
July 30, 2015

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Subject: LER: 2015-002, Safety Relief Valve Upward Setpoint Drift
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59

Dear Sir or Madam:

This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(v)(D) as an "Operation or Condition Prohibited by Technical Specifications" and "Event or Condition that Could Have Prevented Fulfillment of a Safety Function," respectively.

There are no commitments contained in this report.

Questions concerning this report may be addressed to Mr. Chris M. Adner, Regulatory Assurance Manager, at (315) 349-6766.

Sincerely,

A handwritten signature in black ink, appearing to read "BS", with a horizontal line extending to the right.

Brian R. Sullivan
Site Vice President

BRS/CMA/ds

Enclosure(s): LER: 2015-002, Safety Relief Valves Out of Allowable Tolerance

cc: USNRC, Region 1
USNRC, Project Directorate
USNRC, Resident Inspector
INPO Records Center (ICES)



LICENSEE EVENT REPORT (LER)

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 and Information Collections Branch (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.

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4. TITLE
Safety Relief Valve Upward Setpoint Drift

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
06	01	2015	2015	002	00	07	30	2015	N/A	N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: <i>(Check all that apply)</i>			
1	<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)
10. POWER LEVEL 100	<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 checked="" 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

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT Mr. Chris M. Adner, Regulatory Assurance Manager	TELEPHONE NUMBER (Include Area Code) 315-349-6766
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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	SB	RV	T020	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO				

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

The As-Found test results for the eleven Safety / Relief Valve (S/RV) pilot assemblies removed and replaced during the 2014 Refueling Outage at James A. FitzPatrick Nuclear Power Plant (JAF) identified seven (7) S/RV pilot assemblies that lifted at greater than the allowable tolerance of 1145 psig +/- 3% as required by Technical Specification Surveillance Requirement 3.4.3.1. Due to the recurring nature of these failures, the seven S/RV pilot assemblies are assumed to have been inoperable at some point in the operating cycle that preceded the 2014 Refueling Outage resulting in a condition reportable pursuant to 10 CFR 50.73(a)(2)(i)(B).

The S/RV design features an electric actuation capability that provides a diversified means of opening the S/RV's despite the upward setpoint drift. However, the electric lift function is considered a backup to the mechanical S/RV's and is not credited in the safety analyses. Therefore, the Technical Specification inoperability of the seven (7) S/RV's also resulted in a condition reportable pursuant to 10 CFR 50.73(a)(2)(v)(D).

The safety consequences associated with this event are considered low due to the electric actuation capability (verified functional for the entire operating cycle), and the expected pressure response relative to the As-Found setpoints of all eleven S/RV pilots.

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NARRATIVE

Background

The James A. FitzPatrick Nuclear Power Plant (JAF) used eight (8) two-stage and three (3) three-stage Target Rock Safety / Relief Valves (S/RV) [SB] for emergency pressure relief through operating Cycle 21. These valves are located inside the primary containment, and relieve pressure from the main steam lines to the torus.

During each refueling outage, approximately one-third of the S/RV main body assemblies and all eleven of the pilot assemblies are removed and replaced with vendor tested and certified components. The main bodies and pilots that are replaced are sent to a vendor facility for testing, refurbishment, and certification. The test results for pilot assemblies removed in 2014, during Refueling Outage 21, identified seven (7) S/RV pilot assemblies that exhibited upward setpoint drift in excess of the Technical Specification (TS) setpoint tolerance.

JAF has extensive internal Operating Experience in this regard. Causal evaluations identified corrosion bonding as the cause for the upward setpoint drift. Corrosion bonding is a crevice corrosion phenomenon that occurs to highly polished metals in a wetted solution in close proximity to each other. This close proximity (usually a gap of between 0.1 and 100 µm) creates a crevice-like condition between the two wetted surfaces setting up the conditions for crevice corrosion to occur. An oxygen rich environment is created by the accumulation of oxygen in the area of the pilot disc due to the breakdown of water into hydrogen and oxygen. The correct material in the right geometry with exposure to oxygen and high temperature are the conditions which cause corrosion bonding in JAF S/RVs. There is extensive industry experience with corrosion bonding in the Target Rock two-stage S/RVs pilot assemblies.

In order to address the concerns with corrosion bonding, JAF has begun a phased conversion to three-stage Target Rock S/RVs. Industry experience has shown that the three-stage S/RVs are less susceptible to corrosion bonding. The design of the three-stage S/RVs produces a greater mechanical force between the valve disc and seat, resulting in a greater likelihood of overcoming any potential effects of corrosion bonding that might occur.

Event Description

As-Found testing was performed on all eleven Main S/RV pilot assemblies removed in 2014, during Refueling Outage (RO) 21. The testing was conducted by NWS Technologies. The TS setpoint for each S/RV is 1145 psig +/- 3%. During the initial lift test, seven of the eleven pilot assemblies failed to open within the allowed setpoint tolerance of +/-3% (1110.7 to 1179.3 psig). As-Found test results are tabulated below. All three-stage S/RVs passed As-Found testing.

In-service Location	Pilot Serial Number	First Test (psig)	Acceptance Range (1110.7 - 1179.3 psig)
02RV-71B	1045	1250	Unsat
02RV-71D	1052	1191	Unsat
02RV-71G	1110	1231	Unsat
02RV-71H	1195	1235	Unsat
02RV-71J	1218	1277	Unsat
02RV-71K	1217	1243	Unsat
02RV-71L	1235	1203	Unsat

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Subsequent tests performed on six of the seven pilot assemblies passed the acceptance criteria of +/-3%. Pilot number 1045 (02RV-71B) lifted at 3.5% over the acceptance criteria. The cause for the high lift setpoint on the seven pilot assemblies was determined to be corrosion bonding between the pilot valve disc and seat. Due to a history of failure for these S/RVs, it is assumed that they would have been inoperable at some point during the previous operating cycle.

TS Limiting Condition for Operation 3.4.3 requires nine operable S/RVs when in Modes 1, 2 or 3. Specifically, the LCO states: "the safety function of nine S/RVs shall be operable." Since seven of the eleven pilot valves were not within the allowable setpoint tolerance, a condition prohibited by the plant's Technical Specification existed during operating Cycle 21.

Due to the Technical Specification inoperability of the seven S/RVs, a condition that could have prevented the fulfillment of a safety function existed during operating Cycle 21.

As described above, all eleven S/RV's in the plant had new (rebuilt and certified) pilots installed during the 2014 refueling outage. Certified pilot valves were installed and tested as required to verify operability. The currently installed S/RVs are operable.

Cause

The cause for the upward setpoint drift was determined to be corrosion bonding between the S/RV pilot disc and seat [Cause Code B]. Conditions conducive to corrosion bonding exist in the S/RV pilot disc and seat at JAF; the correct material in the right geometry with exposure to oxygen and high temperature. With a bond forming between the pilot disc and seat greater force is required to raise the pilot disc off its seat. Since the normal balance of pilot assembly spring force and steam pressure force necessary to lift the pilot disc corresponds to the nominal setpoint of the S/RV, the pilot disc to seat bond results in a higher pilot lift setpoint.

Extent of Condition

All two-stage S/RVs are susceptible to upward setpoint drift due to corrosion bonding between the pilot valve disc and seat. This is a recurring industry issue that has been the subject of both Nuclear Regulatory Commission (NRC) and Boiling Water Reactor Owner's Group (BWROG) generic assessments.

Failed Component Identification

Manufacturer:	Target Rock Corporation
Manufacturer Model Number:	7567F-10
NPRDS Manufacturer Code:	T020
FitzPatrick Component ID:	02RV-71B, -D, -G, -H, -J, -K, -L

Corrective Actions

Previous corrective actions taken by JAF to address the corrosion bonding issue include:

1. Installed Stellite 21 discs in all eleven S/RVs pilot assemblies during refurbishment at the vendor facility;
2. Installed the electric lift system recommended by the BWROG;
3. Installed enhanced insulation on the S/RVs;
4. Phased replacement of 2-Stage S/RVs with 3-Stage (3 replacements installed during RO-19), which is scheduled for completion prior to exiting Refueling Outage 23.

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Safety Significance

There were no actual consequences to the general safety of the public, nuclear safety, industrial safety, or radiological safety associated with this event.

The potential consequences of this event are associated with the over-pressurization of the Reactor Coolant Pressure Boundary (RCPB). The S/RVs provide overpressure protection for the Reactor Coolant Pressure Boundary (RCPB) as required by the ASME Boiler and Pressure Vessel Code. Events similar to the one reported herein may be significant if design limits are challenged. The potential consequences of this event are considered low based on a) the operation and availability of the Electric Lift System, and b) the expected pressure response relative to the As-Found setpoints of all eleven S/RV pilots.

The Electric Lift System is required by Technical Requirement for Operation (TRO) 3.3.I, and ensures that all S/RVs actuate at or below the TS acceptance criteria. This system energizes solenoid valves which supply pneumatic pressure to assist in actuating the S/RVs. The Electric Lift System was verified to be functional for the entire operating cycle.

The RCPB Overpressure Analysis is performed each fuel cycle based on the worst case anticipated transient with nine S/RVs opening at an analyzed upper limit pressure of 1195 psig, and two S/RVs out of service. As-Found testing confirmed that all S/RVs installed during Cycle 21 would have actuated. Therefore, the transient analysis results are very conservative relative to the expected plant response should a limiting transient have occurred. Even if the two S/RVs with the highest As-Found test results (Serial Nos. 1045 and 1218) are assumed to not actuate, the transient pressure response would be milder than analyzed since the average setpoint of the remaining nine S/RV pilots is 15 psi less than the nominal analyzed setpoint.

Similar Events

1. JAF LER-11-003 "Safety Relief Valve Setpoints Outside Allowable Tolerances," August 8, 2011
2. JAF LER-09-005 "Safety Relief Valve Setpoint Drift," June 22, 2009.
3. JAF LER-07-001 "Safety Relief Valve Setpoint Drift," August 6, 2007.
4. JAF LER-05-002 "Safety Relief Valve Setpoint Drift," June 6, 2005.
5. JAF LER-03-002 "Safety Relief Valve Setpoint Drift," October 16, 2003.
6. JAF LER-01-005 "Safety Relief Valve Setpoint Drift," August 17, 2001.
7. JAF LER-99-003 "Safety Relief Valve Setpoint Drift," March 16, 1999.

References

1. JAF Condition Report CR-JAF-2015-02493, Root Cause Evaluation, Seven S/RV Pilots Failed As-Found Testing
2. JAF Condition Report CR-JAF-2013-04098, Two S/RV Pilots Failed As-Found Testing.
3. JAF Condition Report CR-JAF-2007-02108, Root Cause Analysis Report, Seven of ten S/RV pilots failed as-found testing (testing high out of tolerance).
4. JAF Technical Specification 3.4.3
5. JAF Technical Specification Bases 3.4.3