



10 CFR 50.73

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102-07089-MLL/DJH
July 29, 2015

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

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Unit 3**
Docket No. STN 50-530 / License No. NPF 74
Licensee Event Report 2015-003-00

Enclosed please find Licensee Event Report (LER) 50-530/2015-003-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports a condition prohibited by Technical Specification Limiting Condition for Operation (LCO) 3.5.3, Emergency Core Cooling Systems – Operating. This event resulted when maintenance on a high pressure safety injection pump motor exceeded the LCO completion time. Because this event was anticipated, enforcement discretion had been requested and approved for an additional 24 hours beyond the 72 hour LCO completion time. NOED 15-4-01 was invoked at the time that the completion time was exceeded and was exited 10 hours and 42 minutes later.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the Nuclear Regulatory Commission (NRC) Regional Office, NRC Region IV, and the Senior Resident Inspector.

Arizona Public Service Company makes no commitments in this letter. If you have questions regarding this submittal, please contact Mark McGhee, Nuclear Regulatory Affairs Department Leader, at (623) 393-4972.

Sincerely,

MLL/DJH

Enclosure

cc:	M. L. Dapas	NRC Region IV Regional Administrator
	M. M. Watford	NRC NRR Project Manager
	C. A. Peabody	NRC Senior Resident Inspector PVNGS

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LICENSEE EVENT REPORT (LER)

(See Page 2 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 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.

1. FACILITY NAME

Palo Verde Nuclear Generating Station (PVNGS) Unit 3

2. DOCKET NUMBER

05000530

3. PAGE

1 OF 7

4. TITLE

Damaged High Pressure Safety Injection Pump Motor Journal Bearing

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	
05	30	2015	2015	003	00	07	29	2015	FACILITY NAME	DOCKET NUMBER	
9. OPERATING MODE			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)								
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 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

Mark McGhee, Nuclear Regulatory Affairs Department Leader

TELEPHONE NUMBER (Include Area Code)

623-393-4972

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
D	BQ	MO	W120	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO15. EXPECTED
SUBMISSION
DATE

MONTH	DAY	YEAR

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

On May 30, 2015, emergent maintenance on the Unit 3 train A high pressure safety injection (HPSI) pump motor outboard journal bearing performed under Nuclear Regulatory Commission (NRC) approved notice of enforcement discretion 15-4-01 exceeded the Technical Specification Limiting Condition for Operation (LCO) completion time for LCO 3.5.3, Emergency Core Cooling Systems – Operating, Condition C.1. The HPSI pump had been removed from service on May 27, 2015, at 0628, for planned routine maintenance. During maintenance, it was discovered that the motor outboard journal bearing was damaged. The bearing was replaced and the pump was declared operable on May 30, 2015, at 1710.

The root cause was work instruction weaknesses which resulted in improper reassembly of the HPSI pump motor during planned maintenance in the Unit 3 spring 2015 refueling outage. Immediate corrective actions replaced the damaged outboard motor bearing and properly reassembled the pump and motor. To prevent recurrence, maintenance procedures will be revised to provide enhanced guidance for pump and motor reassembly. An additional action will determine training enhancements needed to address weaknesses with maintenance personnel knowledge.

No previous similar events have been reported to the NRC by PVNGS in the prior three years.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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 Infocollections.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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NARRATIVE

All times are Mountain Standard Time and approximate unless otherwise indicated.

1. REPORTING REQUIREMENT(S):

This Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specification (TS) Limiting Condition for Operation (LCO) 3.5.3, *Emergency Core Cooling Systems (ECCS) - Operating*, that resulted when emergent maintenance on the Unit 3 train A high pressure safety injection (HPSI) (EIS: BQ) pump motor bearing performed under notice of enforcement discretion (NOED) 15-4-01 exceeded the LCO completion time for Condition C.1.

LCO 3.5.3, Condition B.1, requires that one or more inoperable trains be returned to operable status within 72 hours. If operability cannot be restored in 72 hours, the plant must be placed in Mode 3 within 6 hours per Condition C.1 and pressure and temperature reduced to below 1837 pounds per square inch and 485 degrees Fahrenheit within 12 hours per LCO 3.5.3, Conditions C.2 and C.3, respectively.

On May 27, 2015, at 0628, the Unit 3 train A HPSI pump was removed from service for planned routine maintenance. While the pump was inoperable it became apparent that the motor outboard journal bearing was damaged and needed to be replaced. Because the time needed to complete bearing replacement, pump reassembly, and post-maintenance testing would exceed the 72 hour completion time of LCO 3.5.3, Condition B.1, PVNGS requested and was granted enforcement discretion for an additional 24 hours. On May 30, 2015, at 0628, the Unit 3 train A HPSI pump had not been restored to operable status within 72 hours as required by LCO 3.5.3 Condition B.1, and the allowance granted in NOED 15-4-01 was invoked. As a result, the completion time of LCO 3.5.3 Condition C.1 was exceeded and became reportable 78 hours after the pump was made inoperable; however, Condition C.1 was not entered due to enforcement discretion.

This condition was previously reported to the Nuclear Regulatory Commission (NRC) on May 29, 2015, pursuant to Inspection Manual Chapter 0410, Notices of Enforcement Discretion, in Arizona Public Service Company letter 102-07056, dated June 2, 2015 (ADAMS Accession No. ML15154A877), and approved as NOED 15-4-01, per NRC letter dated June 4, 2015 (ADAMS Accession No. ML15155B798).

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2. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

The primary functions of the ECCS are to provide core cooling and negative reactivity insertion to ensure the reactor core is protected after a loss of coolant accident (LOCA), a control element assembly (CEA) ejection accident, a loss of secondary coolant accident, and a steam generator tube rupture (SGTR). The ECCS accomplishes this through the use of redundant active and passive injection subsystems. The active portion of the ECCS consists of two HPSI pumps, two Low Pressure Safety Injection (LPSI) pumps, and associated piping and valves.

The primary function of the HPSI pumps is to inject borated water into the reactor coolant system (RCS) in the event of a LOCA. For small breaks, the HPSI pumps ensure that injected flow is sufficient to maintain inventory at high RCS pressures while a normal plant shutdown is performed. The HPSI pumps also ensure the core remains covered for extended periods of time following a LOCA and can be aligned to simultaneously inject borated water into both hot and cold legs and can draw makeup water either from the refueling water storage tank or from the containment sump.

The HPSI pumps are manufactured by Ingersoll-Rand and are driven by Westinghouse model 1000HP/5810H FRAME/3557 RPM motors. The HPSI pump motor outboard journal bearing is a Westinghouse, model 267C790G01, slinger ring oiled, split sleeve journal bearing with an integrated thrust collar that is approximately 0.25 inches thick and made entirely of babbit material (Figure 1). The thrust collar works in conjunction with a shoulder milled into the shaft, to limit axial shaft movement (Figure 2).

PVNGS TS LCO 3.5.3, states that two ECCS trains shall be operable when in Modes 1 and 2, and in Mode 3 with pressurizer pressure \geq 1837 pounds per square inch absolute or with RCS cold leg temperature \geq 485 degrees Fahrenheit. If one or more trains of ECCS are not operable for reasons other than one LPSI subsystem being inoperable, and at least 100 percent of the ECCS flow equivalent to a single operable ECCS train is available, then the inoperable ECCS train must be restored to operable status within 72 hours. If this LCO Condition cannot be met, the plant must be placed in Mode 3 within 6 hours per Condition C.1, and pressure and temperature reduced to below 1837 pounds per square inch and 485 degrees Fahrenheit within 12 hours per LCO 3.5.3, Conditions C.2 and C.3, respectively.

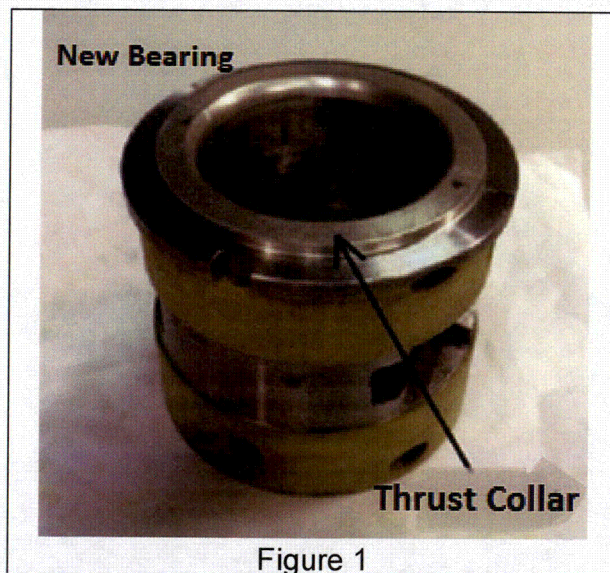


Figure 1

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3. INITIAL PLANT CONDITIONS:

On May 27, 2015, PVNGS Unit 3 was in Mode 1 (Power Operation) at 100 percent power, normal operating temperature, and normal operating pressure. There were no other structures, systems, or components inoperable at the time of the event that contributed to the event.

4. EVENT DESCRIPTION:

On May 27, 2015, at 0628, the Unit 3 train A HPSI pump was removed from service for planned routine maintenance that included bearing oil change-out and sampling. The oil sample taken from the HPSI pump motor outboard journal bearing appeared dark in color and was sent to the PVNGS lubrication laboratory for expedited analysis. Oil viscosity and chemistry were normal but analysis revealed the presence of particles of tin, lead, and copper; indicative of bearing babbitt material. There was no prior history of wear metal particles in samples taken from this bearing. Several oil flushes and pump runs were performed in an attempt to restore the oil properties to within acceptable values. Each of the successive oil flushes and pump runs resulted in improved sample results; however, acceptable values of contaminants were not achieved and the oil remained visibly discolored. Engineering personnel determined the material in the oil was likely the result of damage to the bearing's babbitt thrust collar and concluded the bearing should be replaced. Oil flushes were discontinued and the bearing housing was disassembled for inspection.



Damaged Bearing (loose pieces of recovered babbitt placed for illustration)

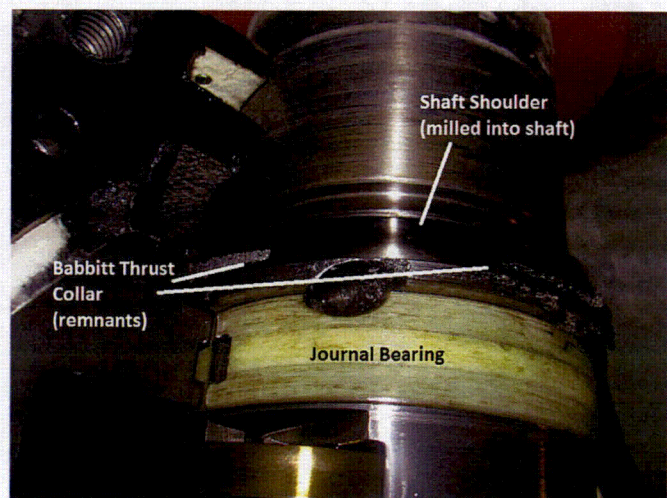


Figure 2

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Inspections and measurements revealed improper adjustment of the pump to motor coupling and displacement of the motor shaft toward the outboard motor journal bearing. This displacement resulted in contact between the milled shaft shoulder and the bearing thrust collar which caused babbitt material to be abraded from the thrust collar (Figure 2). Actions were implemented to replace the journal bearing and properly align the shaft and pump to motor coupling.

On May 28, 2015, at 0659, it was determined the time required to replace the bearing would exceed the 72 hour completion time of LCO 3.5.3 Condition B.1 by as much as 24 hours. A risk assessment concluded that exceeding the LCO by 24 hours would avoid performing an unnecessary plant shutdown that would have no corresponding health or safety benefit. Based on this information, PVNGS requested enforcement discretion in accordance with the NRC NOED process.

On May 29, 2015, at 1753, the NRC verbally approved NOED 15-4-01 that allowed PVNGS an additional 24 hours beyond the 72 hour completion time of LCO 3.5.3, Condition B.1.

On May 30, 2015, at 0628, the 72 hour completion time limit for LCO 3.5.3, Condition B.1, was reached and NOED 15-4-01 was invoked. An extensive protected equipment scheme was established for Unit 3 and all switchyard work was suspended.

The maintenance activities to replace the HPSI pump motor outboard journal bearing and properly align the shaft and pump to motor coupling were completed. Post-maintenance tests, including pump and motor vibration readings and bearing oil samples, were satisfactorily completed. Use of enforcement discretion was discontinued and LCO 3.5.3 Condition B.1 was exited when the Unit 3 train A HPSI pump was declared operable on May 30, 2015, at 1710. PVNGS used 10 hours and 42 minutes of the 24 hours authorized by the NOED. As a result, the completion time of LCO 3.5.3 Condition C.1 was exceeded and became reportable 78 hours after the pump was made inoperable; however, Condition C.1 was not entered due to enforcement discretion.

An investigation was performed to determine the causes of the event and establish corrective actions. It was determined the bearing damage resulted from axial shaft displacement which occurred during recoupling of the motor and pump following maintenance performed during the Unit 3 spring 2015 refueling outage. As part of the investigation, a vendor who specializes in evaluating bearing damage was retained to evaluate the extent of damage to the motor outboard journal bearing and the impact of any damage to the bearing. The focus of the vendor evaluation was to determine whether the bearing would have supported operation for the HPSI pump's 30 day mission time under accident scenario conditions. The vendor evaluation concluded the bearing was capable of operating for an extended period of time in excess of the 30 day mission time. With this information from the vendor and review of pump vibration and performance data, PVNGS engineering personnel determined the HPSI pump was capable of fulfilling its safety function

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during the time frame from completion of pump maintenance in the spring refueling outage to the discovery of the bearing damage.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

This event did not result in a potential transient more severe than those analyzed in chapters 6 and 15 of the Updated Final Safety Analysis Report or result in the release of radioactive materials to the environment. There were no actual safety consequences as a result of this event and the event did not adversely affect the health and safety of the public.

The nuclear safety risk associated with the Unit 3 train A HPSI pump unavailability beyond the 72 hour TS completion time was very small based on the criteria in NRC Regulatory Guide 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*. The incremental conditional core damage probability and incremental conditional large early release probability associated with Unit 3 operation beyond the 72 hour TS completion time was less than $4.1\text{E-}9$ and $2.6\text{E-}11$, respectively. The dominant contributors to core damage and large early release from these models was from small break LOCAs, medium break LOCAs, and steam generator tube ruptures. This risk assessment was performed using the current PVNGS internal events, internal flooding, internal fire, and seismic PRA models.

The condition would not have prevented the fulfillment of a safety function; and, the condition did not result in a safety system functional failure as defined by 10 CFR 50.73 (a)(2)(v).

6. CAUSE OF THE EVENT:

The direct cause for this condition prohibited by LCO 3.5.3 was that the time required to diagnose the presence of wear metal particles in the HPSI pump motor outboard bearing oil samples and to complete repairs and post-maintenance testing exceeded the required action completion time of LCO 3.5.3, Condition C.1.

The investigation determined improper reassembly of the train A HPSI pump motor during planned refueling outage maintenance resulted in axial displacement of the motor shaft and damage to the thrust collar on the outboard HPSI pump motor journal bearing.

The root cause of the event was work instruction weaknesses which resulted in improper reassembly of the train A HPSI pump to motor coupling during planned maintenance in the Unit 3 spring 2015 refueling outage. Contributing causes were the lack of specific written guidance for determining magnetic center of HPSI pump motors during maintenance and weaknesses with maintenance personnel knowledge for proper coupling of the HPSI pumps and motors.

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7. CORRECTIVE ACTIONS:

Immediate corrective actions included replacement of the damaged HPSI pump motor outboard journal bearing, proper reassembly of the pump and motor, and completion of post-maintenance testing. Following maintenance, the train A HPSI pump was returned to service and declared operable.

To prevent recurrence, maintenance procedures will be revised to include detailed instructions for performing pump and motor coupling on the HPSI pumps and other similar pumps identified in the evaluation. An additional action will determine training enhancements needed to address weaknesses with maintenance personnel knowledge for proper coupling of the HPSI pumps and motors.

8. PREVIOUS SIMILAR EVENTS:

No previous similar events have been reported to the NRC by PVNGS in the prior three years.