



A subsidiary of Pinnacle West Capital Corporation

10 CFR 50.73

Palo Verde Nuclear
Generating Station

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102-05684-DCM/SAB/DCE
April 20, 2007

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

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
License No. NPF 51
Licensee Event Report 2005-006-00

Please find attached Licensee Event Report (LER) 50-529/2005-006-00 prepared and submitted pursuant to 10 CFR 50.73. This LER reports the partial fouling of Unit 2 "B" Diesel Generator Fuel Oil Strainer and Filters which resulted in a condition prohibited by the Technical Specifications.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the NRC Regional Office, NRC Region IV and the PVNGS Senior Resident Inspector. If you have questions regarding this submittal, please contact Ray E. Buzard, Section Leader, Regulatory Affairs, at (623) 393-5317.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

DM/SAB/DCE/gt

Attachment

cc: **B. S. Mallett** NRC Region IV Regional Administrator
M. T. Markley NRC NRR Project Manager
G. G. Warnick NRC Senior Resident Inspector for PVNGS

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NRC FORM 366 (6-2004)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB: NO. 3150-0104		EXPIRES: 06/30/2007			
<h2 style="margin: 0;">LICENSEE EVENT REPORT (LER)</h2> <p style="margin: 5px 0;">(See reverse for required number of digits/characters for each block)</p>									
1. FACILITY NAME Palo Verde Nuclear Generating Station (PVNGS) Unit 2				2. DOCKET NUMBER 05000529		3. PAGE 1 OF 10			
4. TITLE Condition Prohibited by Technical Specifications Due to Partial Fouling of "B" Diesel Generator (EDG) Fuel Oil Strainer									
5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	
5	15	2005	2005	- 006 -	00	04	20	2007	
			8. OTHER FACILITIES INVOLVED						
			FACILITY NAME			DOCKET NUMBER			
						05000			
			FACILITY NAME			DOCKET NUMBER			
						05000			
9. OPERATING MODE		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)							
4		<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)(vii)(A)							
10. POWER LEVEL 0		<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)(vii)(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 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									
FACILITY NAME						TELEPHONE NUMBER (Include Area Code)			
Ray E. Buzard, Section Leader, Regulatory Affairs						623-393-5317			
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
E	DE	FLT-STR	C634	Y					
14. SUPPLEMENTAL REPORT EXPECTED					15. EXPECTED SUBMISSION DATE				
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)					<input checked="" type="checkbox"/> NO				
					MONTH DAY YEAR				
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)									
<p>During the period May 15 through November 3, 2005, Unit 2 operated in Modes 1 through 5 following a refueling outage with an inoperable "B" train emergency diesel generator (EDG 2B), contrary to Technical Specifications 3.0.3, 3.0.4, 3.8.1, and 3.8.2. Even though EDG 2B successfully completed required surveillance tests during the period, duplex fuel oil strainers and filters exhibited increasing differential pressures caused by particulates suspended in the fuel oil day tank. Filter elements were found in the strainer housing instead of the required strainer elements on November 3, 2005. At least one EDG remained functional throughout the period. The root cause was accumulated day tank sediment that became suspended in the fuel oil when the tank was refilled following an outage inspection. Ineffective equipment trending and work priority management resulted in untimely identification and correction of the partially loaded strainers. The EDG 2B fuel oil day tank was subsequently cleaned. Other corrective actions include scheduled cleaning of the other 5 station EDG fuel oil day tanks, and improvements to equipment trending and management of work priorities. No similar events were reported in the previous three years.</p>									

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

NOTE: All times listed in this event report are approximate and Mountain Standard Time (MST) unless otherwise indicated.

1. REPORTING REQUIREMENT(S):

This LER (50-529/2005-006-00) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B), to report the partial fouling of Unit 2 "B" Emergency Diesel Generator (2B EDG (EIS: EK)) Fuel Oil Strainer and Filters (EIS:STR/FLT) which resulted in the 2B EDG being inoperable from May 15, 2005 until its partially fouled strainers were cleaned and restored to service on November 3, 2005. Though EDG 2B was inoperable, the EDG safety function was maintained during the period. With the EDG inoperable, the station did not comply with Technical Specifications Limiting Conditions for Operation (TS LCOs) 3.0.3, 3.0.4, 3.8.1, and 3.8.2, including required actions, on multiple occasions during the period.

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

The standby power supply for each of the two safety-related load groups consists of one emergency diesel generator (EDG), complete with its fuel storage and transfer systems (EIS: DC) and accessories. The standby power supply functions as a source of alternating current (ac) power for safe unit shutdown in the event of loss of preferred (offsite) power.

Refer to Figure 1 at the end of the LER for a simplified fuel oil system piping diagram.

Each EDG has its own separate fuel oil system which delivers fuel from its underground fuel oil storage tank located outside the EDG building to an 1100 gallon horizontal cylindrical diesel fuel oil day tank (EIS: TK). The fuel enters the day tank through the top, spilling into the tank. A feed line located approximately $\frac{3}{4}$ " from the bottom on one end of the day tank directs flow through a 74 micron duplex strainer to a booster pump. Each side of the duplex strainer houses two strainer elements (four total for each strainer). One side of the duplex strainer is aligned for service and the other side is in standby in the event the in-service strainer differential pressure (d/p) increases excessively. The engine driven booster pump provides approximately 11 gpm fuel flow at 30 psig through a duplex 5 micron filter, which is aligned and operated in a manner similar to the strainers. Each side of the duplex filter houses two filter elements (four total for each filter). The EDG uses

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approximately 6.45 gallons per minute (gpm) of fuel at full electrical load and excess fuel is directed back to the day tank via a fuel oil cooler (EIS: CLR). The day tank level control system automatically maintains level in the day tank above the minimum level. The strainer and filter differential pressures (d/p) are monitored and alarm at 5 pounds per square inch differential (psid) and 10 psid increasing, respectively, to alert the operators of potential excessive strainer or filter loading. The alarms annunciate on the local EDG control panel (EIS: PL) and generate a control room annunciator (EIS: ANN) and alarm typer "DGYS4 DG B LO PRIORITY TRBL" report. The alarms provide timely indication of the potential need to shift the respective duplex filter or strainer to the standby side to permit continued operation of the EDG. The loaded filter or strainer side may then be cleaned or replaced while the diesel engine continues to run.

3. INITIAL PLANT CONDITIONS:

On May 15, 2005, Unit 2 entered Hot Shutdown, (Mode 4) with reactor coolant system temperature greater than 210 degrees Fahrenheit during its twelfth refueling outage (U2R12). The fuel oil storage tank and fuel oil day tank for EDG 2B had been drained, inspected, and refilled during U2R12. The EDG 24 hour surveillance test run had also been satisfactorily completed. As discovered on November 3, 2005, filter elements were housed in the 2MDGBF11A strainer housing instead of the required strainer elements. No other major structures, systems, or components were inoperable at the start of the event that contributed to the event.

4. EVENT DESCRIPTION:

During a Nuclear Regulatory Commission (NRC) baseline inspection in January 2007, an NRC inspector questioned the evaluations and corrective actions related to the November 3, 2005 condition in which filter elements were found in EDG 2B fuel oil strainer 2MDGB11A instead of the required strainer elements. The strainer had been opened on November 3, 2005 for cleaning because of a high strainer d/p alarm that was received during the previous day's monthly EDG 2B surveillance test (November 2, 2005).

During the U2R12 outage, in the spring of 2005, the station inspected the fuel oil day tank interior; however, the day tank was not cleaned as part of the inspection. Operations

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personnel (utility, licensed) declared EDG 2B OPERABLE on May 14, 2005 based on the successful completion of scheduled maintenance and surveillance testing.

During the monthly EDG surveillance test on May 25, 2005, the control room received a high 2MDGBF12B filter d/p alarm and Operations personnel (utility, non-licensed) successfully manually shifted to the opposite side standby filter, 2MDGBF12A, during the test in accordance with the alarm response procedure. Operating logs for EDG 2B filter d/p following the filter shift indicated that filter d/p trends returned to the typical range of values that existed prior to U2R12 outage tank inspections and remained there through November 3, 2005. Operations personnel generated a work order to replace 2MDGBF12B filter elements. The assigned work priority of the work order required completion within seven days; however, the replacement was not completed until July 20, 2005.

Beginning on May 6, 2005, strainer d/p readings for EDG 2B strainer 2MDGBF11B increased with the accumulation of run hours through October 5, 2005. Intermittent high strainer d/p alarms occurred during August 11, 2005 and September 8, 2005 surveillance tests and on October 5, the alarm came in and did not clear. After completing the surveillance test, the operating crew shifted to the standby strainer, 2MDGBF11A, and generated a work order to clean the strainer. The cleaning was not completed until November 3, 2005.

On November 2, 2005, strainer 2MDGBF11A reached the high d/p alarm setpoint and alarmed during the monthly EDG 2B surveillance test. Operations personnel did not shift to the standby strainer because the opposite side strainer 2MDGBF11B had not been cleaned since it alarmed on October 5, 2005. Operations completed the surveillance test with 2MDGBF11A in service and concluded the test results were acceptable. EDG operating logs indicated a high reading of 4.2 psid with the control room logs stating the d/p reached 4.6 psid. Work orders were generated to clean fuel oil strainer 2MDGBF11A and to verify the strainer d/p indication and alarm calibration. The calibration verification was completed on November 2, 2005 without adjustments.

On November 3, 2005 mechanics cleaned strainer 2MDGBF11B first, then opened strainer 2MDGBF11A. The mechanics found filter elements in the 2MDGBF11A strainer housing instead of the required strainer elements. Condition Report (CRDR) 2844023 was issued to address the non-conforming condition (filter) found in strainer 2MDGBF11A.

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Investigation revealed that the filter element had been inadvertently installed in the strainer since 1991.

On February 20, 2007, station personnel concluded that EDG 2B was not operable during the period May 14, 2005 through November 3, 2005 based on review of prior maintenance records and 2005 fuel oil filter and strainer differential pressure (d/p) trends.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

With the exception of the time EDG 2B was removed from service for maintenance (28 hours, 11 minutes commencing at 02:00 am on July 20, 2005), EDG 2B remained functional during the period it was inoperable from May 14 - November 3, 2005. On July 20, EDG 2A was OPERABLE. Therefore, the standby power safety function was maintained throughout the period.

Throughout the inoperable period, a minimum of approximately 15 hours of engine run time remained prior to the point at which the EDG would have experienced reduced electrical load carrying capability because of filter or strainer excessive d/p. The 15 hour time estimate was based on conservative assumptions for strainer and filter loading rates and vendor data. No more than 7 hours would have been required to change out or clean the strainers or filters. The 7 hour estimate was based on the availability of qualified individuals to assess the condition, plan the work, obtain parts, and perform the maintenance, including call out, using the procedures that existed during that period. Therefore, though inoperable, with the exception of the July maintenance, EDG 2B would have fulfilled its mission time of 7 days of continuous operation because reasonable actions would have been taken to clean the strainer or replace the filter within fifteen hours.

Table 1 below provides a summary of the mode ascensions that occurred on Unit 2 during the period May 14 - November 3, 2005. Mode ascensions above Mode 5 while EDGs are inoperable are prohibited by TS LCO 3.0.4.

Table 2 summarizes the occasions EDG 2A was inoperable.

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Redundant "A" and "B" engineered safety feature trains remained powered by operable off-site power sources throughout the period.

The condition did not prevent the fulfillment of any safety function and did not result in a safety system functional failure as defined by 10CFR50.73 (a) (2) (v).

6. CAUSE OF THE EVENT:

The direct cause of Unit 2 EDG B being inoperable between May 14, 2005 and November 3, 2005 was the increased loading rate of the fuel oil filters/strainers following the U2R12 outage. The root cause of the partial filter and strainer loading was particulates that originated in the fuel oil day tank. When the tank was refilled after the U2R12 outage inspection, the fuel oil spilling into the tank from the top stirred up the previously accumulated, undisturbed sedimentation film on the tank bottom. The particulates remained suspended and were trapped by the strainers and filters causing the high differential pressures.

A contributing cause was the ineffective implementation of equipment trending and management of work priorities such that the combination of these failures jeopardized the redundancy of the EDG fuel oil filters and strainers. EDG fuel oil strainer and filter d/p trend reviews were not conducted by either Operations or Engineering. The completion of filter 2MDGBF12B's replacement and strainer 2MDGBF11B's cleaning did not conform to expectations for timely corrective actions.

7. CORRECTIVE ACTIONS:

Following the cleaning of EDG 2B's fuel oil strainers, the station inspected and cleaned each of the duplex fuel oil strainers on the station's remaining 5 EDGs (EDGs 2A, 1A, 1B, 3A, and 3B). The filters were inspected and replaced in each of the six station EDGs as well. Both of these actions were completed by March 15, 2006. None of the strainer housings inspected contained filters instead of strainer baskets. None of the other station EDGs exhibited high filter or strainer d/p trends.

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The day tank for EDG 2B was reinspected and cleaned on March 23, 2007. The engineer and mechanics found dirt and sedimentation in the tank. The station will inspect and clean the remaining fuel oil day tanks for the five other station EDGs. A preventive maintenance task will be implemented to clean and inspect each of the fuel oil day tanks every ten years.

The station will implement specific monitoring of EDG operating logs as part of EDG engine analysis preventive maintenance tasks. Operations will modify the method of electronic equipment log data entry to ensure equipment trends are more readily monitored and identified. Interim measures included issuance of an Operations night order with expectations for data entry and trending.

The station will review and adopt measures to assure maintenance work is scheduled and completed in accordance with assigned work priorities.

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8. PREVIOUS SIMILAR EVENTS:

No prior events occurred in the previous three years that involved the same underlying root cause, failure, or sequence of events.

Table 1 – Unit 2 Mode Changes with EDG 2B Inoperable

Date/Time	Mode Entry	Applicable TS LCO Actions Not Met
May 15, 2005 / 5:16 am	Entered Mode 4	3.0.4, 3.8.1.b, Condition B, H
May 20, 2005 / 4:37 pm	Entered Mode 1	3.0.3, 3.0.4, 3.8.1.b, Condition B, H
August 26, 2005 / 1:53 am	Entered Mode 1	3.0.3, 3.0.4, 3.8.1.b, Condition B, H
October 18, 2005 / 12:14 pm	Entered Mode 4	3.0.4, 3.8.1.b, Condition B, H
October 20, 2005 / 12:03	Entered Mode 1	3.0.3, 3.0.4, 3.8.1.b, Condition B, H

Notes:

This table shows mode entries into Mode 4 and Mode 1 but omits entries into Modes 3 and 2; however, these mode changes were also contrary to TS LCO 3.0.4.

During the period May 14 - November 3, 2005, Unit 2 was shutdown on two occasions, once to Mode 3 on August 22, 2005 (LER 0500529/2005-004-01) and once to Mode 5 on October 12, 2005 (LER 0500529/2005-005-00).

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Table 2 – Occasions EDG 2A was Inoperable

Period	Event
May 14, 2005, 3:32 – 4:04 pm	Placed Diesel Generator 'A' in OFF to support surveillance testing, returned to standby, Unit in Mode 5, no irradiated fuel movements, core alterations or reactivity additions.
August 1, 2005 2:57 pm – August 3, 2005 12:55 pm	Unit 2 Essential Spray Pond System "A" declared inoperable because of failed flow indication. Safety function of EDG 2A was not adversely impacted. EDG 2A remained functional. Unit in Mode 1.
August 24, 2005 1:00 am – August 25, 2005 1:16 pm	EDG 2A declared inoperable for planned maintenance. EDG 2A was not functional. Irradiated Fuel Movement from 11:43 am – 12:11 pm. Unit in Mode 2.
October 23, 2005, 10:10 – 10:43 am	Placed EDG 2A in OFF to support surveillance testing, returned to standby. Unit in Mode 1.

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Figure 1
DG FO System - Basic Sketch

