



John P. Broschak
Vice President Engineering

ET 13-0037

December 5, 2013

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

Subject: Docket No. 50-482: Licensee Event Report 2013-009-00, "Post-Fire Safe Shutdown Design Issue May Impact Ability to Achieve Safe Shutdown"

Gentlemen:

The enclosed Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(B) regarding an unanalyzed condition that could potentially affect post fire safe shutdown equipment at Wolf Creek Generating Station.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4085, or Mr. Michael J. Westman at (620) 364-4009.

Sincerely,

A handwritten signature in black ink, appearing to read "John P. Broschak".

John P. Broschak

JPB/rlt

Enclosure

cc: M. L. Dapas (NRC), w/e
C. F. Lyon (NRC), w/e
N. F. O'Keefe (NRC), w/e
Senior Resident Inspector (NRC), w/e

Handwritten initials "IE22" above "NRR" in black ink.

NRC FORM 366 (10-2010)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB: NO. 3150-0104		EXPIRES: 10/31/2013			
LICENSEE EVENT REPORT (LER) (See reverse 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 Service 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 WOLF CREEK GENERATING STATION					2. DOCKET NUMBER 05000 482		3. PAGE 1 OF 4			
4. TITLE Post-Fire Safe Shutdown Design Issue May Impact Ability to Achieve Safe Shutdown										
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
10	09	2013	2013	009	00	12	05	2013		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)								
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)		
10. POWER LEVEL 100		<input type="checkbox"/> 20.2203(a)(1)		<input type="checkbox"/> 20.2203(a)(4)		<input checked="" 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)		
		<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 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 Michael Westman, Manager Regulatory Affairs								TELEPHONE NUMBER (Include Area Code) (620) 364-4009		
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	
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) On October 9, 2013 during a review of external operating experience, Wolf Creek Nuclear Operating Corporation (WCNOC) determined that a fire in some areas containing direct current (DC) ammeter circuits could result in secondary fires outside the primary fire area. This condition could impact the ability to achieve safe shutdown. The cause of this deficiency is that the original plant design did not specify fuse protection of these DC shunt ammeter circuits. The postulated scenario is a fire that causes a short to ground on cables associated with the DC ammeters, concurrent with a short to ground on a safety related 125 VDC circuit on the negative side of the same battery source. Since the ammeter circuits are not overcurrent protected, they could overheat and ignite anywhere along their route. The negative side of the 125 VDC circuit is fuse protected, but the fuse may not clear prior to ammeter cable ignition if a high resistance short to ground exists. The safety significance of this event is considered low. An hourly fire watch was established in the affected areas. A modification will be implemented to correct this deficiency.										

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PLANT CONDITIONS AT THE TIME OF THE EVENT

100 % Power
Mode 1

There were no structures, components or systems (SSC) that were inoperable at the start of the event that contributed to the event.

DESCRIPTION OF THE EVENT

On October 9, 2013 during a review of a Palo Verde event report (ENS 49411), Wolf Creek Nuclear Operating Corporation (WCNOC) determined that a fire in fire areas containing certain direct current (DC) [EIS: EF, M] ammeter circuits could result in secondary fires outside the primary fire area. This condition could only occur under specific circuit fault conditions and, in the unlikely event it occurs, could impact the ability to achieve safe shutdown. At Wolf Creek Generating Station (WCGS), DC shunt ammeters are used in various systems. A review of these systems determined that only the safety related 125 VDC (NK) [EIS: EF] system was affected.

Direct current (DC) ammeters that monitor safety related 125 VDC (NK) [EIS: EF] batteries and chargers are connected to shunt devices on the positive polarity. The ammeter circuits are #16 AWG and the original plant design did not provide overcurrent protection on these circuits. The postulated scenario is a fire that causes a short to ground on cables associated with the DC ammeters, concurrent with a short to ground on a safety related 125 VDC circuit on the negative side of the same battery source. This condition is known as a ground fault equivalent hot short (GFEHS). The ammeter circuits are not overcurrent protected and, consequently, they could overheat and ignite anywhere along their route. All DC shunt ammeters impacted by this condition are connected to the positive polarity. The negative polarity of the faulted circuit is overcurrent protected at the distribution panel or as part of a control power network on a branch circuit. These overcurrent protection devices (typically fuses) range in size from a few amps up to 100 amps. A review of the time-current characteristic curve for the fuses compared with the cable damage curve shows that a high resistance fault may not produce sufficient current to clear the fuse prior to ignition of the cable. However, a bolted or low resistance fault would likely clear the negative side fuse, preventing the occurrence of secondary fires.

Multiple simultaneous fires are not analyzed for impact on the ability to achieve and maintain safe shutdown. The NK system DC shunt ammeter circuits provide remote or local indication of current flow in the batteries and chargers. Local current indication is not a concern for post-fire safe shutdown because the local ammeters are in the primary fire area and any secondary fires would be contained to the fire area of origin. However, fire damage to remote ammeter circuits in the NK system have the potential to cause secondary fires outside the fire area of origin because the ammeter circuits run in various areas in the plant.

There are two DC shunt ammeters associated with each NK bus, one used to measure battery output current and the other to measure charger output current. There are four NK busses at WCGS. As a result, eight DC shunt ammeter circuits were identified as being potentially affected by this condition.

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BASIS FOR REPORTABILITY

When a Post-Fire Safe Shutdown (PFSSD) issue is identified in which no or insufficient guidance is available to Operations to readily mitigate the postulated fire induced equipment failure, the issue is considered reportable under 10 CFR 50.72(b)(3)(ii)(B) and 10 CFR 50.73(a)(2)(ii)(B) as an unanalyzed condition that significantly degrades plant safety. This is based on NUREG-1022, "Event Reporting Guidelines 10 CFR 50.72 and 50.73," Revision 3, Section 3.2.4. This section provides the following example:

.... if fire barriers are found to be missing, such that the required degree of separation for redundant safe shutdown trains is lacking, the event would be reportable as an unanalyzed condition that significantly degraded plant safety.

A 10 CFR 50 Appendix R circuit separation issue, which could result in undesired equipment failure with a resulting adverse effect on PFSSD capability, is considered by WCGS to be equivalent to a condition where fire barrier protection is deficient.

As such, WCGS reported this condition pursuant to 10 CFR 50.73(a)(2)(ii)(B) for any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

CAUSE OF EVENT

The cause of this deficiency is that the original plant design did not specify fuse protection of the DC shunt ammeter circuits. The condition that causes this event is a fire induced GFEHS. The potential for a GFEHS was only recently confirmed during fire testing documented in NUREG/CR-7100, Direct Current Electrical Shorting in Response to Exposure Fire (DESIREE-FIRE), dated April, 2012. Prior to this testing, most deterministic safe shutdown analyses did not consider the effects of DC hot shorts through the ground plane. However, the failure mode was previously postulated in NUREG/CR-6834, Circuit Analysis – Failure Mode and Likelihood Analysis, dated September, 2003, but no testing existed to back up the theory. Furthermore, NUREG/CR-6834 was developed to support fire probabilistic risk assessment (PRA) studies, not traditional safe shutdown circuit analysis. Since no testing existed prior to DESIREE-FIRE that confirmed the GFEHS circuit failure mode, it is probable that traditional circuit analyses did not consider this failure mode to be credible.

The event would have been prevented had the original plant design included overcurrent protection of the DC shunt ammeter circuits. However, review of Institute of Electrical and Electronics Engineers (IEEE) Standard IEEE-484, Recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Substations, and IEEE-946, Recommended Practice for the Design of DC Auxiliary Powered Systems for Generating Stations found that these standards do not require overcurrent protection on DC shunt ammeter circuits. Since the GFEHS phenomenon is a recent discovery, and since DC ammeters are not required to provide diagnostic indication to meet 10 CFR 50, Appendix R requirements, the original 10 CFR 50, Appendix R safe shutdown analysis did not include DC shunt ammeter circuits in the safe shutdown equipment list. Consequently, they were not analyzed for impact on PFSSD. Also, the PFSSD re-analysis conducted between 2000 and 2009 did not include DC shunt ammeter circuits due to these circuits not being required for PFSSD.

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In 2011, WCGS completed a PFSSD associated circuits study. The study evaluated associated circuits due to spurious operation, common power supply and common enclosures. The ammeter circuits are considered associated circuits by common enclosure. The 2011 study did not identify the ammeter circuits as associated and, therefore, the circuits were not included in the study.

CORRECTIVE ACTIONS

An hourly fire watch was established in the affected areas.

A modification will be implemented to correct this deficiency. The WCGS corrective action program is tracking this action in Condition Report 74959.

SAFETY SIGNIFICANCE

This issue has low safety significance. A fire in the Control Room of such magnitude and severity as to cause an evacuation and plant shutdown is extremely unlikely. Based on the Fire Hazards Analysis (E-1F9905), the combustible loading in the Control Room is low and interior finish materials meet or exceed the surface flammability requirements of applicable standards. Cables entering the Control Room are IEEE 383 rated. Large concentrations of cables in the Control Room trenches are protected with an automatic Halon extinguishing system and automatic smoke detectors are located in select control cabinets and trenches.

A severe fire in a cable chase where the DC ammeter cables run is considered very low probability due to the absence of ignition sources, the presence of a wet pipe automatic sprinkler system and automatic smoke detection that alarms in the main control room.

A severe fire in the switchboard rooms and battery rooms where the DC shunts are located would not challenge this event because the primary fire and any secondary fires would be contained in the fire area of origin. In addition, these areas are protected by a Halon fire suppression system and automatic smoke detection that alarms in the main control room.

An hourly fire watch has been implemented in the affected fire areas.

OPERATING EXPERIENCE/PREVIOUS SIMILAR OCCURRENCES

LER 2011-008-00 reported that during a review of the post-fire safe shutdown analysis for valve EFHV0060, "ESW Return from CCW Heat Exchanger," a condition was discovered where a fire in the Control Room could cause valve EFHV0060 to open. Valve EFHV0060 is required to be closed for post-fire safe shutdown when operating Train 'B' essential service water (ESW).

LER 2010-003-00 reported a condition where a postulated fire induced hot short could have prevented operation of the Train 'B' diesel generator if a fire occurred in the Control Room. This condition was due to an inadequate review of Control Room circuitry for impact on PFSSD following a Control Room fire.