WOLF CREEK
NUCLEAR OPERATING CORPORATION

Russell A. Smith
Plant Manager

January 20, 2012

WO 12-0012

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

Reference: Letter WO 11-0076, dated October 7, 2011, from S. E. Hedges, WCNOC, to USNRC

Subject: Docket No. 50-482: Licensee Event Report 2011-009-01, "Inadequate Oil Analysis Causes Inoperable Auxiliary Feedwater Pump Longer than Allowed Outage Time"

Gentlemen:

The referenced submittal, Licensee Event Report (LER) 2011-009-00, "Inadequate Oil Analysis Causes Inoperable Auxiliary Feedwater Pump Longer than Allowed Outage Time," described an event involving the turbine driven auxiliary feedwater pump and exceeding a Technical Specification Required Action Completion Time. Supplemental LER 2011-009-01 is enclosed to also report this event in accordance with 10 CFR 50.73(a)(2)(ii)(B), 10 CFR 50.73(a)(2)(v)(B), and 10 CFR 50.73(a)(2)(v)(D).

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4156, or Mr. Gautam Sen at (620) 364-4175.

Sincerely,

Russell A. Smith

RAS/rlr

Enclosure: LER 2011-009-01

cc: E. E. Collins (NRC), w/e
J. R. Hall (NRC), w/e
N. F. O'Keefe (NRC), w/e
Senior Resident Inspector (NRC), w/e

IE22
NRR

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION
(10-2010)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Inadequate Oil Analysis Causes Inoperable Auxiliary Feedwater Pump Longer than Allowed Outage Time

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
										05000
08	14	2011	2011	- 009 -	01	01	20	2012	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☒ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☒ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☒ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Gautam Sen, Manager Regulatory Affairs	(620) 364-4175

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
A	BA	P	I075	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On 8/11/2011 at 1145 CDT the turbine driven Auxiliary Feedwater (AFW) pump was declared inoperable due to oil sample results that indicated a high particulate count in the turbine lube oil system. The cause of the condition was determined to be residual quantities water, dirt, wear and oxide particles found after an inadvertent addition of Fyrquel to the system in March 2011. The lube oil system was drained, flushed and filled multiple times followed by oil sample testing to determine particulate content.

On 8/14/2011, Wolf Creek Nuclear Operating Corporation requested a Notice of Enforcement Discretion (NOED) to extend the Completion Time for the turbine driven AFW pump an additional 24 hours. The NRC granted the approval of the NOED on 8/14/2011. A Technical Specification required shutdown was initiated on 8/15/2011. The turbine driven AFW pump was returned to operable status on 8/15/2011 and the plant was returned to full power.

Procedure I-ENG-004, "Lubricating Oil Analysis," was revised on 12/07/2011 to specify the actions to take when oil sample results reach alert levels and to strengthen oil sample processing controls. An evaluation is in progress to confirm that the turbine driven AFW pump was capable of performing its specified safety function from 3/11/2011 to 8/11/2011.

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PLANT CONDITIONS AT THE TIME OF THE EVENT

Mode 1
100% power

DESCRIPTION OF THE EVENT

On 8/11/2011 at 1145 Central Daylight Time (CDT) the turbine driven Auxiliary Feedwater (AFW) pump [EIIS Code: BA-P] was declared inoperable due to oil sample results that indicated a high particulate count in the turbine lube oil system [EIIS Code: TD]. The results exceeded the International Organization for Standardization (ISO) Solid Contamination Code action limit provided in procedure I-ENG-004, "Lubricating Oil Analysis." Technical Specification (TS) 3.7.5 Condition B was entered with a Completion Time of 72 hours to restore the pump to operable status. At the time of the event, no systems, structures, or components other than the turbine driven AFW pump were inoperable that contributed to the event. Prior to this event, the turbine driven AFW pump last demonstrated performance of its safety function during completion of surveillance test procedure STS AL-103, "TDAFW Pump Inservice Test," on 6/20/2011. It is an Ingersoll-Rand model 6HMTA-6 pump.

Work was immediately started to drain and flush the oil from the turbine driven AFW pump and replace it with new oil. The turbine lube oil system was drained and flushed multiple times. Following the third drain and fill of the turbine driven AFW pump oil, surveillance test procedure STS-AL-103 was performed satisfactorily. However, oil sample results continued to indicate elevated particulate levels.

Additional effort to correct this condition involved cleaning bearing housings where particulates have a high potential of being located followed by re-circulating the oil in the system through an in line re-circulation skid with a fine (2 micron) filter until the particulate limit was met. This method of filtering process proved effective. However, the time required to perform the pump post maintenance surveillance, take an additional oil sample, and perform additional filtering, would have resulted in exceeding the 72-hour Completion Time of TS 3.7.5, Required Action B.1.

On 8/14/2011, Wolf Creek Nuclear Operating Corporation (WCNOC) requested a Notice of Enforcement Discretion (NOED) to not enforce compliance with the actions required in TS 3.7.5 Required Actions C.1 and C.2 for a period of 24 hours. The NRC gave verbal approval of the NOED on 8/14/2011 at 0945 CDT.

On 8/15/2011 at 1145 CDT, an evaluation of the oil sample results had not been completed and the unit began a TS required shutdown in accordance with TS 3.7.5, Required Actions C.1 and C.2. On 8/15/2011 at 1203 CDT, the turbine oil was determined to be acceptable and the turbine driven AFW pump was declared operable. The TS required shutdown was terminated with the unit at 81% power. The unit was returned to full power on 8/15/2011 at 1425 CDT.

The cause of the condition was determined to be residual quantities of water, dirt, wear and oxide particles as well as small quantities of Fyrquel remaining in the turbine lube oil system after an inadvertent addition of 8 ounces of Fyrquel to the system in March 2011. Immediately following the addition of Fyrquel and prior to operating the turbine driven AFW pump in March 2011, the system was flushed, cleaned and the proper lubricant added.

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BASIS FOR REPORTABILITY

WCNOC requested and received a NOED from the NRC to not enforce compliance with the actions required in TS 3.7.5 Required Actions C.1 and C.2 for a period of 24 hours. The turbine driven AFW pump was inoperable for longer than allowed by the Completion Time of TS 3.7.5, Required Action B.1. The event is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B) for any operation or condition which was prohibited by the plant's TS.

Engineering judgment was used to determine that the turbine driven AFW pump was capable of performing its specified safety function from 3/11/2011, when an oil sample was taken but no particulate count was performed, to 8/15/2011, when the turbine oil was determined to be acceptable. The final engineering evaluation has been delayed, awaiting vendor input. As a result, until the engineering evaluation is completed, this event is being additionally reported in accordance with 10 CFR 50.73(a)(2)(ii)(B), 10 CFR 50.73(a)(2)(v)(B), and 10 CFR 50.73(a)(2)(v)(D).

During the time period of 3/11/2011 through 8/11/2011, a motor driven AFW pump [EIIS Code: BA-P] was periodically removed from service for short periods of time for scheduled maintenance. Therefore, two AFW pumps, one motor driven and the turbine driven, may have been simultaneously inoperable. This meets the 10 CFR 50.73 criteria for a condition that could have prevented the fulfillment of a safety function. Therefore, this condition is reportable in accordance with 10 CFR 50.73(a)(2)(v)(B) as a system needed to remove residual heat and reportable with 10 CFR 50.73(a)(2)(v)(D) as a system needed to mitigate the consequences of an accident.

When the failure of a motor driven AFW pump is postulated as an assumed single limiting failure in conjunction with the inoperability of the turbine driven AFW pump, only a single motor driven AFW pump would be available for mitigation of a Feedline Break (FLB). Safety acceptance criteria for the FLB analysis would not be met in this scenario. Consequently, the extended period of time that the turbine driven AFW pump may have been inoperable represents an unanalyzed condition that significantly degrades plant safety and is reported in accordance with 10 CFR 50.73(a)(2)(ii)(B).

ROOT CAUSE

The direct cause of the turbine driven AFW pump inoperability was lube oil analysis controls were less than adequate.

Monitoring of oil sample results is included in procedure I-ENG-004, "Lubricating Oil Analysis." On 3/11/2011, an oil sample analysis was taken and sent to an offsite laboratory for analysis. The oil analysis did not include a particulate count. On 7/8/2011, another oil sample was taken and sent offsite for analysis. A particulate count was provided and showed the turbine driven AFW pump oil failed to meet the oil particulate action level specified in procedure I-ENG-004. Procedure I-ENG-004 did not provide specific guidance on the type of testing to perform on the oil sample or specify that additional testing should be requested if an action limit was exceeded.

The primary contributor to exceeding the 72-hour TS Completion Time and NOED allowed extension of 24 hours is a lack of knowledge of the variation in particulate counting test methods and test results. The turbine lube oil system was drained multiple times, an in-line filtration method was used, new oil

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was being tested for cleanliness, and new oil was circulated through the system by running the turbine, yet particulate count results continued to exceed the I-ENG-004 acceptance criteria. The reliability of particulate count testing is now known to fluctuate by as much as two ISO codes values depending on testing method practices and instruments. Sources of variation can occur from air bubbles, water, and additives or incompatible fluids entrapped in the oil, and these soft particles generate some of the largest spikes in ISO cleanliness values

Residual Fyrquel would be expected to act like an interfering soft particle and contribute to inaccurate particle counts when a sample is tested. Per the ASTM D7657 standard, interfering soft particles are an undissolved, dispersed material (such as an additive) within an oil blend or substance that is formed during the service life of an oil blend. When these substances are present in a sample and not completely solubilized, they are likely to be counted by an optical particle counter in a similar manner to dirt and wear metal particles, air bubbles, and free water droplets.

CORRECTIVE ACTIONS

The lube oil system was drained, flushed and filled multiple times followed by oil sample testing to determine particulate content.

Procedure I-ENG-004, "Lubricating Oil Analysis," was revised on 12/07/2011 to include the following:

1. Specify the actions to take when oil sample results are at the ISO Solid Contamination Code action limit. Specify the additional testing that will be performed if the ISO Alert Limit is reached.
2. Critical components that require the ISO Code for oil analysis have been specified.
3. Oil sample processing controls have been strengthened by formalizing an oil sample tracking method to provide consistent testing methods and trending for critical components.
4. A process for testing new oil prior to use has been developed to establish a baseline.

SAFETY SIGNIFICANCE

The WCNOC final quantitative risk analysis indicated that the incremental conditional core damage probability (ICCDP) for the 24-hour extension was 1.20E-07, and the incremental conditional large early release probability (ICLERP) for the 24-hour extension was 5.18E-09. The calculated value for ICCDP and ICLERP met the Regulatory Issue Summary 2005-01, "Changes to Notice of Enforcement Discretion (NOED) Process and Staff Guidance," guidance thresholds.

To further mitigate the risk impact, WCNOC implemented a series of compensatory actions for the duration of the enforcement period and continued until the turbine driven AFW pump was restored to operable status.

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With regard to a postulated FLB, if both motor driven AFW pumps are available, applicable acceptance criteria for the FLB transient can be met. However, if the failure of a motor driven AFW pump is postulated as an assumed single limiting failure in conjunction with inoperability of the turbine driven AFW pump, the safety analysis acceptance criteria for the FLB cannot be met. Specifically, one of the acceptance criteria in the analysis of record is to ensure that hot leg saturation is precluded. Should the plant be reliant on a single motor driven AFW pump following a FLB, hot leg saturation would not be precluded.

OPERATING EXPERIENCE/PREVIOUS SIMILAR OCCURRENCES

None.