

# WOLF CREEK

NUCLEAR OPERATING CORPORATION

November 2, 2017

Stephen L. Smith  
Plant Manager

WO 17-0081

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


Subject: Docket No. 50-482: Licensee Event Report 2017-003-00, "ARV and MSSV Tornado Missile Vulnerabilities Result in Unanalyzed Condition"

To Whom It May Concern:

The enclosed Licensee Event Report (LER) 2017-003-00 is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B), 10 CFR 50.73(a)(2)(ii)(B), 10 CFR 50.73(a)(2)(v)(A), and 10 CFR 50.73(a)(2)(v)(B).

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4093, or Cynthia R. Hafenstine at (620) 364-4204.

Sincerely,



Stephen L. Smith

SLS/rt

Enclosure: LER 2017-003-00

cc: K. M. Kennedy (NRC), w/e  
B. K. Singal (NRC), w/e  
N. H. Taylor (NRC), w/e  
Senior Resident Inspector (NRC), w/e

IEZZ  
NRR



**LICENSEE EVENT REPORT (LER)**

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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.

<b>1. FACILITY NAME</b> Wolf Creek Generating Station	<b>2. DOCKET NUMBER</b> 05000      482	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
ARV and MSSV Tornado Missile Vulnerabilities Result in Unanalyzed Condition

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
09	07	2017	2017	003	00	11	02	2017		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)**

<b>1</b>	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<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)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<b>10. POWER LEVEL</b>  <b>100</b>	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)
	<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)(D)	<input type="checkbox"/> 73.77(a)(2)(i)
	<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)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)
	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER	Specify in Abstract below or in NRC Form 366A	

**12. LICENSEE CONTACT FOR THIS LER**

LICENSEE CONTACT Cynthia R. Hafenstine, Manager Nuclear and Regulatory Affairs	TELEPHONE NUMBER (Include Area Code) (620) 364-4204
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**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**

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

MONTH	DAY	YEAR

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

On September 7, 2017, Wolf Creek Generating Station (WCGS) was in Mode 1 at 100 percent power. During evaluation of protection for safety-related equipment from the damaging effects of tornados, WCGS personnel determined that the non safety-related exhaust lines from safety-related atmospheric relief valves (ARVs) and main steam safety valves (MSSVs) could be crimped by tornado generated missiles. If these are crimped completely, these components may be unable to perform their safety functions. The ARVs and MSSVs were declared inoperable and Enforcement Guidance Memorandum (EGM) 15-002, "Enforcement Discretion for Tornado-Generated Missile Protection Noncompliance," Revision 1 was applied. Immediate compensatory measures consistent with EGM 15-002 were implemented within the time allowed by the applicable Technical Specification Limiting Condition(s) for Operation. The ARVs and MSSVs were subsequently declared operable but nonconforming. These tornado missile vulnerabilities existed since the original plant construction. Actions will be taken to establish compliance for these components either by a plant modification or employing a methodology for addressing tornado missile non-conformances.

On April 5, 2017, WCGS personnel provided a 10 CFR 50.72 notification in Event Notification (EN) 52666 concerning tornado missile protection issues known at that time. As stated in EGM 15-002, the NRC will exercise enforcement discretion for subsequent tornado missile 10 CFR 50.72 notifications. Therefore, no 10 CFR 50.72 notification was made for this condition.



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

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1. FACILITY NAME Wolf Creek Generating Station	2. DOCKET NUMBER 05000-482	3. LER NUMBER		
		YEAR 2017	SEQUENTIAL NUMBER 003	REV NO. 00

**NARRATIVE**

**PLANT CONDITIONS PRIOR TO EVENT**

Mode -- 1  
Power -- 100%  
No structures, systems, or components (SSCs) were inoperable at the start of this event which contributed to this condition.

**BACKGROUND DOCUMENTS**

Nuclear Regulatory Commission (NRC) Enforcement Guidance Memorandum (EGM) 15-002, "Enforcement Discretion for Tornado-Generated Missile Protection Noncompliance," provides guidance to exercise enforcement discretion when an operating power reactor licensee does not comply with a plant's current site-specific licensing basis for tornado-generated missile protection. Specifically, discretion would apply to the applicable Technical Specification (TS) Limiting Condition(s) for Operation (LCO) that would require a reactor shutdown or mode change in the event a licensee could not meet TS LCO required action(s) within the TS completion time.

NRC Interim Staff Guidance DSS-ISG-2016-01, "Clarification of Licensee Actions In Receipt of Enforcement Discretion Per Enforcement Guidance Memorandum EGM 15-002," provides interim staff guidance to facilitate staff understanding of expectations for consistent oversight associated with implementing enforcement discretion for tornado missile protection noncompliance(s) per EGM 15-002.

Appendix A to DSS-ISG-2016-01 provides guidance for acceptable initial and comprehensive compensatory measures for licensee use in implementing the enforcement discretion outlined in EGM 15-002. The licensee should declare (log) the utilization of EGM 15-002, inform the resident inspector, and enter the issue into the corrective action program. For initial compensatory measures, it is expected that the measures listed are already in place at sites that may be affected by severe weather, such as tornados and/or hurricane force winds. The measures should be verified as current and readily deployable within a very short timeframe.

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX].

**DESCRIPTION OF EVENT**

Wolf Creek Generating Station (WCGS) provides steam for the main turbine through 4 main steam supply lines [SB]. Each main steam supply line has 1 safety-related (SR) atmospheric relief valve (ARV) [RV] and 5 SR main steam safety valves (MSSVs) [SV]. The function of each ARV is to remove reactor decay heat during normal reactor cooldown when the main steam isolation valves are closed or the turbine bypass system is not available. The MSSVs provide overpressure protection for the secondary side of the steam generators (SGs) and the main steam piping, in accordance with ASME Section III code requirements. The exhaust piping from both the ARVs and MSSVs that exit the Auxiliary Building is non-safety related (NSR). During the evaluation of tornado missile protection of SR equipment, it was identified that the exhaust piping from these valves are exposed to potential tornado missiles. If any of the exhaust lines are completely crimped, it could prevent the associated valve from performing its safety function. Safe shutdown can be accomplished with two functioning SGs. While it is highly unlikely that a single design basis tornado missile could crimp enough ARV or MSSV exhaust lines to affect the functionality of more than two SGs, there currently exists no analysis to prove this.



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**NARRATIVE**

Therefore, based on the lack of an adequate analysis to demonstrate that one design basis tornado missile couldn't affect the safe shutdown of the plant, at 1325 Central Daylight Time (CDT), on September 7, 2017, the ARVs and MSSVs were declared inoperable. TS LCO 3.7.1 Condition C (one or more SGs with 4 or more MSSVs inoperable) and TS LCO 3.7.4 Condition C (3 or more ARV lines inoperable for reasons other than excessive leakage) were entered at this time. Initial compensatory measures were put in place consistent with EGM 15-002. Based on the guidance provided in EGM 15-002, upon completion of these initial compensatory measures the ARVs and MSSVs were subsequently declared operable but non-conforming. The compensatory measures were completed within the allowed TS LCO Completion times.

This condition is reportable under 10 CFR 50.72. However, consistent with EGM 15-002, after the initial 10 CFR 50.72 notification has been made for tornado missile vulnerabilities the NRC will exercise enforcement discretion for subsequent tornado missile 10 CFR 50.72 notifications. Therefore, no 10 CFR 50.72 notification was made for this condition. The initial tornado missile vulnerability notification to the NRC was completed on April 5, 2017 in Event Notification #52666.

**BASIS FOR REPORTABILITY**

This condition is reportable as required by:

- 10 CFR 50.73(a)(2)(i)(B) for a condition that is prohibited by Technical Specifications.
- 10 CFR 50.73(a)(2)(ii)(B) for an event or condition that results in the plant being in an unanalyzed condition that significantly degrades plant safety.
- 10 CFR 50.73(a)(2)(v)(A) for a condition that at the time of discovery could have prevented the fulfillment of a safety function of structures or systems needed to shut down the reactor and maintain it in a safe shutdown condition.
- 10 CFR 50.73(a)(2)(v)(B) for a condition that at the time of discovery could have prevented the fulfillment of a safety function of structures or systems needed to remove residual heat.

**CAUSE OF EVENT**

This condition is an original plant design legacy issue. Due to the historical nature of this vulnerability, a specific cause has not been identified.

**CORRECTIVE ACTIONS**

All of the following corrective actions are being tracked by Condition Report 115590.

Initial compensatory measures taken in accordance with EGM 15-002 include verification that severe weather procedures were up-to-date, verification that procedures and equipment were up-to-date supporting Diverse and Flexible Coping Strategies (FLEX), ensuring Operations personnel were current on their training to these procedures, and implementing measures to heighten station awareness until the vulnerabilities have been corrected.

More comprehensive compensatory measures have been implemented and consist of revising Wolf Creek procedure OFN SG-003, "Natural Events" to include:

- 1) a requirement to walk down susceptible components post-severe weather, and
- 2) adding staged equipment to address any crimped exhaust pipe.

Ultimately, the nonconformance of the ARVs and MSSVs may be addressed through physical plant modifications, industry approved risk evaluation, or another method consistent with WCGS' licensing basis.



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**NARRATIVE**

**SAFETY SIGNIFICANCE**

As documented in EGM 15-002, tornado missile scenarios that may lead to core damage are very low probability events because SR SSCs are typically designed to withstand effects of tornados. For a tornado missile-induced scenario to occur, a tornado would have to hit the site and result in the generation of missiles that would hit and fail vulnerable, unprotected SR equipment, and/or unprotected SR subcomponents in a manner that is non-repairable and non-recoverable. In addition, because plants are designed with redundancy and diversity, the tornado missiles would have to affect multiple trains of safety systems and/or means of achieving safe shutdown.

The NRC has completed a generic risk analysis of potential tornado missile protection noncompliances to examine the risk significance of these scenarios. This assessment documents a conservative, bounding-type analysis of the risk significance for plant facilities. The generic analysis assumed that core damage would occur if a tornado hit a plant located in the most active tornado region in the country and that it caused a tornado-generated missile to fail all emergency core cooling equipment at the plant with no ability to recover. Given this conservative assumption, the staff's study established that the core damage frequency (CDF) associated with tornado missile-related noncompliances are well below CDFs requiring immediate regulatory action. In summary, the generic bounding risk analysis performed by the NRC concluded that this issue is of low risk significance.

During a postulated design basis tornado, the conditions documented could have resulted in a loss of safety function for the ARVs and MSSVs, though with a very low likelihood. The main steam lines from each SG have 1 ARV and 5 MSSVs. Each of the MSSVs have 2 exhaust pipes. Therefore the total number of exhaust pipes which are exposed to potential tornado missiles is 44, (4 ARV exhausts, 40 MSSV exhausts). The exhaust piping for each of the ARVs is 8" steel pipe, surrounded by a 78" diameter silencer. The exhaust piping for each of the MSSVs is 16" steel pipe. The exposed portions of the ARV and MSSV exhaust piping are 102 feet and 90 feet above ground level respectively. Missile protection is provided from the north by the Turbine building, and the south by the Reactor building. The exhaust pipes are arranged with the ARVs, as well as each set of 5 MSSVs, in a line running east to west. The ARVs and MSSVs would be capable of performing their safety functions in the event that a missile was to shear off any of the exhaust piping. Thus, the only failure mechanism of concern would be crimping of these exhaust lines. In the unlikely event that tornado conditions would cause design basis tornado missiles to impact the ARV or MSSV exhaust piping, due to their robust design, their elevation, and their physical arrangement, it would be almost impossible to completely crimp enough exhaust lines to cause more than 2 SGs to become nonfunctional. Since WCGS is designed to be able to safely shut down with 2 functioning SGs, the likelihood that the safe shutdown of WCGS would be challenged by this type of event, is very low.

As WCGS has not experienced an actual tornado missile event, this condition had no actual safety consequences impacting plant or public safety. Therefore, this condition had a very low safety significance.

**OPERATING EXPERIENCE/PREVIOUS EVENTS**

The only previous tornado vulnerability identified at WCGS was that reported in LER 2017-002-00.