

February 7, 2011

MEMORANDUM TO: Michael T. Markley, Chief  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

FROM: Alexander R. Klein, Chief */RA/*  
Fire Protection Branch  
Division of Risk Assessment  
Office of Nuclear Reactor Regulation

SUBJECT: FIRE PROTECTION SAFETY EVALUATION INPUT FOR WOLF CREEK  
GENERATING STATION REGARDING LICENSE AMENDMENT  
REQUEST FOR DEVIATION FROM FIRE PROTECTION PROGRAM  
REQUIREMENTS (TAC NO. ME3766)

By letter dated April 13, 2010, "Docket No. 50-482: License Amendment Request for Deviation from Fire Protection Program Requirements," available at Agencywide Documents Access and Management System (ADAMS), Accession No. ML101100479, and supplemented by letter dated June 1, 2010, "Docket No. 50-482: Response to Request for Additional Information Related to License Amendment Request for Deviation from Fire Protection Program Requirements" ADAMS Accession No. ML101590671 Wolf Creek Nuclear Operating Corporation (WCNOC) requested a license amendment for Wolf Creek Generating Station (WCGS), which proposed changes to the WCGS fire protection program (FPP) to allow removal of the high/low pressure interface designation from the pressurizer power operated relief valves (PORVs) and their associated block valves.

The Fire Protection Branch (AFPB) has reviewed the amendment request, and WCGS's June 1, 2010, response to the staff's request for additional information. Enclosed is our safety evaluation input.

CONTACT: Daniel Frumkin NRR/DRA      Gary Cooper, NRR/DRA  
(301) 415-2280                              (301) 415-8578

Based on our review, AFPB concludes that the request to remove the high/low pressure interface designation from the pressurizer PORVs and their associated block valves, in this particular instance and in conjunction with the other installed fire protection features, are sufficient to assure that public health and safety are maintained in lieu of the protection committed to in the approved FPP.

This completes our action on TAC No. ME3766. If you have any questions regarding this input, please contact us.

Docket No: 50-482  
Operating License: NPF-42

Enclosure:  
As stated

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                                 DFrumkin      BSingal

**ADAMS ACCESSION NO.: ML110110670**

\*via email

OFFICE:	NRR/DRA/AFPB	TL:NRR/DRA/AFPB	NRR/DRA/AFPB	BC:NRR/DRA/AFPB
NAME:	GCooper	DFrumkin	PQualls *	AKlein
DATE:	01/2 /11	01/24/11	01/31/11	02/07/11

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. [PM TO COMPLETE] TO

FACILITY OPERATING LICENSE NO. NPF-42

WOLF CREEK NUCLEAR OPERATING CORPORATION, ET AL.

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

## 1.0 INTRODUCTION

By letter dated April 13, 2010, "Docket No. 50-482: License Amendment Request for Deviation from Fire Protection Program Requirements," available at Agencywide Documents Access and Management System (ADAMS), Accession No. ML101100479, and supplemented by letter dated June 1, 2010, "Docket No. 50-482: Response to Request for Additional Information Related to License Amendment Request for Deviation from Fire Protection Program Requirements," ADAMS Accession No. ML101590671, Wolf Creek Nuclear Operating Corporation (WCNOC) requested a license amendment for Wolf Creek Generating Station (WCGS), which proposed changes to the WCGS fire protection program (FPP) to allow removal of the high/low pressure interface designation from the pressurizer power operated relief valves (PORVs) and their associated block valves. The current WCGS Updated Safety Analysis Report (USAR) defines the PORVs and their associated downstream block valves as high/low pressure interfaces.

Approval of this license amendment request (LAR) and the completion of the licensee's proposed modifications, will allow control room operator actions to close the PORVs by manual control room switches instead of operator manual actions (OMAs) outside the control room to remove power from the PORVs and other components. Without the removal of the high/low pressure interface designation, procedures would be required to remain in place to perform operator manual actions outside of the control room to mitigate the unlikely occurrences of concurrent DC phase-to-phase hot shorts between two cables in areas with fixed suppression.

The evaluation below provides information on the high/low pressure interface designation addressed by this amendment.

## 2.0 REGULATORY EVALUATION

Regulatory requirements for fire protection are contained in (1) Section 50.48, "Fire protection," (2) General Design Criterion 3, "Fire protection," of Appendix A, and (3) Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," of Part 50, "Domestic Licensing of Production and Utilization Facilities," to Title 10 of the *Code of Federal Regulations* (10 CFR 50). The types of circuit failures to be analyzed is addressed in this license amendment are specified in Section III.G.2 of Appendix R to 10 CFR 50 (III.G.2).

10 CFR 50, Appendix R, applies to licensed nuclear power electric generating stations that were operating prior to January 1, 1979. Since WCGS was licensed after January 1, 1979, WCNOC

ENCLOSURE

is not required to meet 10 CFR 50, Appendix R. However, the licensee committed to meeting the requirements of III.G.2 in its approved FPP, per License Condition 2.C (5) and Appendix 9.5E of the WCGS USAR. Therefore, the WCGS FPP must provide the established level of protection as intended by III.G.2.

This LAR is seeking approval by the Commission, pursuant to License Condition 2.C (5), to make changes to the approved FPP as described in the WCGS USAR.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Area Description

WCNOC document E-1F9905, Fire Hazard Analysis (FHA), Revision 3, ADAMS Accession No. ML101110404 provided the information for Tables 1, 2, and 3. All plant fire areas described below have interior wall and structural components that are constructed of steel, reinforced concrete, and other noncombustible materials. Interior wall surfaces are generally painted concrete masonry units or concrete. Floor areas have also been coated. These paints and coatings have been considered in the fire hazards analysis.

Table 1 - Fire Area Description

<b>Fire Area</b>	<b>Description</b>
A-8	Fire Area A-8 is the Auxiliary Building, 2000' elevation general area and includes the following: corridors, filter, valve and demineralizer compartments, Sampling Room, Boron Meter & R.C. Activity Monitor Room, Volume Control Tank Room, Containment Spray Additive Tank Area, Seal Water Heat Exchange Room and the Exit Vestibule.
A-11	Fire Area A-11 is a single room cable chase located on the 2000' elevation of the Auxiliary Building.
A-16 South	Fire Area A-16 is the general corridor area on the 2026' elevation of the Auxiliary Building. A 20 ft. combustible control zone separation area is located between columns A7 and A8 from the containment wall to the east wall of RHR Heat Exchanger Room 1309.
A-17	Fire Area A-17 is the South Electrical Penetration Room on the 2026' elevation of the Auxiliary Building.
A-18	Fire Area A-18 is the North Electrical Penetration Room on the 2026' elevation of the Auxiliary Building.
A-27	Fire area A-27 is the Reactor Trip Switchgear Room on the 2026' elevation of the Auxiliary Building.
C-18	Fire Area C-18 is a single room cable chase located on the 2016' elevation of the Control Building.
C-21	Fire Area C-21 is the Lower Cable Spreading Room on the 2032' elevation of the Control Building.
C-22	Fire Area C-22 is the Upper Cable Spreading Room on the 2073'- 6" elevation of the Control Building.
C-23	Fire Area C-23 is a single room (3505) cable chase located on the 2032' elevation of the Control Building.
C-24	Fire Area C-24 is a single room (3504) cable chase located on the 2032' elevation of the Control Building.
C-30	Fire Area C-30 is a single room (3617) cable chase located on the 2047'- 6" elevation of the Control Building.

C-33	Fire Area C-33 is a single room (3804) cable chase located on the 2073'- 6" elevation of the Control Building.
RB	Fire Area RB consists of Fire Areas RB1 through RB11, which are separate fire areas and encompasses all elevations of the Reactor Building. However, for the purposes of the PFSSD analysis, the reactor building is treated as one fire area, which is designated as Fire Area RB.

As indicated in the Wolf Creek FHA, all of the fire areas in Table 1 are separated from all other fire areas by fire barrier construction and penetration closure assemblies (fire door, fire dampers, and penetration seals) that satisfy at least one of the following criteria:

- They have been directly qualified by 3-hour fire endurance testing in accordance with criteria of the applicable controlling standard (ASTM E-119 (walls, ceilings, floors), ASTM E-152, UL-10B, UL-555 (fire dampers), or IEEE-634 (cable-penetration fire stop test) for the respective barrier assembly protective feature.
- They have been evaluated as providing an equivalent level of protection.
- They have been evaluated as providing protection commensurate with the fire hazards present.

### 3.2 Defense-In-Depth Review

The regulation requires that licensees ensure that the ability to achieve and maintain safe shutdown is preserved following a fire event by extending the concept of defense-in-depth to:

- (1) prevent fires from starting;
- (2) detect rapidly, control, and extinguish promptly those fires that do occur; and
- (3) provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant.

#### 3.2.1 Fire Prevention

The WCNOC supplemental letter dated June 1, 2010 stated the combustible materials are administratively controlled in the plant areas where the PORVs and related block valve cables are routed so as not to allow large quantities of unattended combustibles in those areas. No unattended combustible materials are allowed in containment during power operation. Additionally, all cables in the plant that are routed in raceways with PORV cables are Institute of Electrical and Electronics Engineers, Inc. (IEEE) Standard-383 rated thermoset cables.

The Wolf Creek FHA indicates that safety-related cable in the general plant area is qualified to IEEE-383. All single conductors inside control panels meet the flame resistance requirements of Insulated Power Cable Engineers Association S-19-81 or S-61-402.

The FHA states that lighting, fire protection, communication and specialty cables which are flame retardant, but not qualified to IEEE-383; and other communication and specialty cable, are limited in use in the following manner:

1. Covered with a flame retardant coating per the requirements of Branch Technical Position APCSB 9.5-1, Appendix A; or

2. Installed in a totally enclosed metal conduit system; or
3. Consist of short lengths of exposed cable between the end of a totally enclosed metal conduit system routed to a component and the connection to the component (e.g., at light fixtures and public address devices); or
4. Located in non-safety-related areas which are separated from safety-related areas by fire rated boundaries; or
5. Evaluated on a case-by-case basis for adverse impact on the fire protection program.

Table 2 - Additional Fire Prevention Information by Fire Area

FIRE AREA	DISCUSSION
A-8	The cumulative combustible loading classification for Fire Area A-8 is Low. Administrative controls ensure that only new cartridges for the Chemical and Volume Control System (CVCS) filters, in quantities required for immediate use will be brought into this area and the containers are removed after they are emptied.
A-11	No credible in situ ignition sources are present within cable chases and introduction of a transient ignition source is administratively controlled.
A-16 South	The cumulative combustible loading classification for Fire Area A-16 is Low. A 20 ft. combustible control zone separation area is administratively maintained to strictly control transient combustibles in the limiting separation area between redundant PFSSD circuits. In situ combustibles within the combustible control zone do not pose a fire propagation path that would disable both trains of redundant PFSSD equipment.
A-17	The cumulative combustible loading classification for Fire Area A-17 is Low. All cable in panels RJ160A/B/C/D meets the vertical flame requirements of Insulated Power Cable Engineers Association (IPCEA) S-19-81 and/or IEEE 383 for flame resistance. The panels are provided with key locks to control access to the panel interiors.
A-18	The cumulative combustible loading classification for Fire Area A-18 is Low. All cable in panels RJ159A/B/C/D meets the vertical flame requirements of IPCEA S-19-81 and/or IEEE 383 for flame resistance. The panels are provided with key locks to control access to the panel interiors.
A-27	The cumulative combustible loading classification for Fire Area A-27 is Low.
C-18	No credible ignition sources are present within cable chases and introduction of a transient ignition source is administratively controlled.
C-21	The cumulative combustible loading classification for Fire Area C-21 is Low. The C-21 cable spreading room contains predominantly cable.
C-22	The cumulative combustible loading classification for Fire Area C-22 is Low. The C-22 cable spreading room contains predominantly cable.
C-23, C-24, C-30, C-33	No credible in situ ignition sources are present within cable chases and introduction of a transient ignition source is administratively controlled.
RB	The cumulative combustible loading classification for Fire Area RB is Low. A system is provided to collect and contain lubricating oil for each reactor coolant pump (RCP).

### 3.2.2 Detection, Control and Extinguishment

WCNOC supplemental letter dated June 1, 2010 indicates that automatic fire suppression and detection is provided in all areas, outside containment, where PORV cables are routed. Within containment, the cable trays of concern have wire type heat detection installed.

The Wolf Creek USAR, Section 9.5.1.2.2, states that the powerblock fire protection system is designed in substantial compliance with the requirements of the American Nuclear Insurers (ANI) and the National Fire Codes of the National Fire Protection Association (NFPA). Codes and standards considered in the design of the fire protection system are listed in USAR Table 9.5.1-1. The applicable NFPA detection and suppression codes from the table are NFPA 72D-1975 for fire detection, NFPA 12A-1973 for Halon systems and NFPA 13-1973, 1975, 1976 and 1991 for sprinkler systems.

USAR Table 9.5E-1 states that the fire brigade compliment, training, medical qualification, and personal protective equipment complies with 10 CFR 50 Appendix R, Section H, Fire Brigade. The USAR also states that the WCGS fire brigade is composed of a minimum of five persons from the on duty work force and the brigade does not include any of the plant physical security personnel.

Per the Wolf Creek FHA, all of the fire areas below have fire extinguishers and hose stations provided in the general area for manual fire fighting with the exception of fire areas A-17 and A-18 which have hose stations only.

Table 3 - Additional Detection, Control and Extinguishment Information

<b>Fire Area</b>	<b>Detection, Control and Extinguishment Capability</b>
A-8	An automatic smoke detection system is installed throughout the fire area except in several rooms with low combustible loading and no safe shutdown circuits or equipment. An automatic preaction sprinkler system is installed over cable tray concentrations in Rooms 1301, 1314, and 1320. Pressurizer PORV and block valves cables are routed in Rooms 1301 and 1320.
A-11	Total coverage automatic fire detection and suppression are installed in this area. A wet pipe sprinkler system is provided for the area. The sprinkler system will aid in controlling the fire event until manual suppression can be applied, as necessary.
A-16 South	Total coverage automatic smoke detection is provided in this area. A pre-action sprinkler system is located in areas with high concentrations of cable trays. In addition to the ceiling level sprinkler system, the east corridor, from column line A1 to A4, is provided with an intermediate level sprinkler system, located below the lowest cable tray in the corridor. The pre-action sprinkler system will aid in controlling the fire event until manual suppression can be applied, as necessary.
A-17, A-18 & A-27	These fire areas have automatic fire detection and a fixed automatic Halon fire suppression system installed. The detection and suppression systems are both total coverage systems,
C-18, C-21, C-22, C-23, C-24, C-30, & C-33	All fire areas have total coverage automatic fire detection and suppression installed with the exception of C-21 (Lower Cable Spreading Room) and C-22 (Upper Cable Spreading Room) having partial automatic suppression.  Both cable spreading rooms have an automatic preaction sprinkler system installed at the ceiling. The location of the closed sprinkler heads considers cable tray sizing and arrangement and cables are designed to allow wetting down with suppression water without electrical faulting in accordance with USAR Table 9.5A-1 comparison to APCSB 9.5-1, Appendix A, Section F.3 (Cable Spreading Room).

Fire Area	Detection, Control and Extinguishment Capability
RB	<p>Linear heat detection is installed above each reactor coolant pump and in areas where cable trays are concentrated. Duct smoke detection is provided for each containment cooler. The Containment atmospheric control filter adsorber units are provided with a thermistor type continuous detector. The above fire detectors are alarmed in the control room and the alarms are zoned for quick identification of the area in alarm. Manual-pull fire alarm stations are located near hose stations and alarm locally and in the Control Room.</p> <p>A fixed, manually charged, closed head sprinkler system is provided over the cable trays in Zones RB-3 and RB-4. Portable extinguishers and manual hose stations are also installed. The hose stations are spaced at no more than 100-foot intervals. The hose station locations are such that all accessible areas of the Reactor Building are adequately covered by at least one hose stream.</p>

### 3.2.3 Preservation of Safe Shutdown Capability

The licensee states that combustible materials in the areas where the PORVs and block valves cables are routed are administratively controlled. In all of the fire areas outside containment where the PORVs cables are routed, the cables are routed in raceway that is protected by automatic fire suppression and detection. In containment, the concentrations of cable trays have wire type heat detection installed. With the existing fire prevention controls, the detection and suppression in the areas where PORVs cables are routed, a fire damaging PORVs cables is unlikely, and if a damaging fire were to occur it would be rapidly annunciated to the control room and the fire brigade dispatched.

The licensee indicates that all cables in raceway with PORVs cables are IEEE Standard-383 rated thermoset (TS) cables and thermoset cables are not considered vulnerable to self-ignited cable fires. NUREG/CR-6931, CAROLFIRE Test Report Volume 1, Section 9.1.1, states "Inter-cable shorting between two TS-insulated cables that could cause hot shorts and the spurious operation of plant equipment was found to be a plausible failure mode, although the likelihood of this failure mode is low in comparison to intra-cable short circuits leading to spurious operation. While no detailed statistical analysis has been performed, it appears that the conditional probability (given cable failure) of spurious actuations arising from this specific failure mode is small in comparison to that previously estimated for spurious actuations from intra-cable shorting."

In response to the NRC request for additional information, WCNOC letter dated, June 1, 2010 (ML101590671) the licensee stated that the proposed plant modifications will re-wire the PORVs control circuits. This rewiring will ensure that the PORVs can be closed from the control room given a single proper polarity inter-cable hot short in combination with any number of intra-cable hot shorts. This rewiring will also prevent fire induced spurious operation of the PORVs with the control room hand switch in the closed position. Operations procedures will be revised to include the control room actions for spuriously open PORVs.

The PORVs are designed to close on a loss of electrical power. Therefore, if the cables with the hot shorts lose power due to fire damage or the fire induced opening of breakers or fuses, the PORVs should close as designed. Therefore, only a limited number of hot short failure modes can cause a loss of control of the PORVs.

The only fire induced failure that could circumvent the proposed plant modifications is two simultaneous independent proper polarity (positive to positive and negative to negative) inter-cable hot shorts. As stated above, the only reason for WCGS to assume these inter-cable hot shorts is the high-low pressure designation of the PORVs. If the designation were to remain, WCGS would be required to postulate two simultaneous cable failures modes, which would necessitate operator manual actions from outside the control room to remove power from the PORVs and other plant equipment that have 125VDC cables in the same raceway with PORV cables. To preemptively remove power from other plant equipment that may not be damaged by the fire, could reduce the equipment and systems available to the operators for post-fire safe shutdown.

In the unlikely event of a fire damaging PORV control cables and the inter-cable positive to positive and negative to negative combination of hot shorts occur, a PORV may open and remain open until the hot shorts clear. The discharged steam from the PORV is piped to the pressurizer relief tank (PRT), inside containment, where it is cooled and condensed by mixing with water. The piping downstream of the pressurizer PORVs and block valves is designed for the expected pressure and thus will not rupture upon opening of the PORVs. Unless manual actions are taken to close the PORVs or the hot shorts clear, the steam will continue to be contained within the PRT until the pressure reaches a level that the PRT rupture disk ruptures, as designed. This will not lead to an outside containment loss of coolant accident.

### 3.3 Conclusion of Technical Evaluation

The proposed LAR would allow WCGS, to remove the high/low pressure interface designation from the PORVs and their associated block valves. The licensee has indicated that the following defense-in-depth measures are in place to prevent damage to the PORV control cables: combustible materials in the areas where the PORVs and related block valves cables are routed are administratively controlled; automatic fire suppression and detection is provided in all of the areas outside containment, where PORV cables raceways are routed; within containment, the cable concentrations have wire type heat detection installed and no unattended combustible materials are allowed in containment during power operation.

The proposed modifications would allow operating a control room switch to prevent or mitigate a fire induced spurious opening of the PORVs. The only scenario that would remain that could cause the PORVs to open would involve two simultaneous inter-cable proper polarity cable failures. To mitigate this scenario the licensee would have to remove power from the PORVs and other plant equipment. The operator manual action to remove power from other plant equipment to prevent or mitigate the results of the analyzed two simultaneous cable failures, could have an adverse affect on PFSSD.

Changing the high-low pressure commitments will allow the licensee to analyze PORV cables for a single proper polarity hot short between two cables (inter-cable) in combination with any number of internal cable (intra-cable) hot shorts. Research has shown that the likelihood of inter-cable hot shorts that can cause spurious equipment operation is low in comparison to intra-cable shorts that can cause spurious equipment operation. The proposed modifications and control room operator actions provide an adequate level of protection as described in Section III.G.2 of Appendix R to 10 CFR 50.

In summary, based on the above discussion, the proposed change would revise the Renewed Facility Operating License to deviate from certain WCGS FPP commitments. The WCGS USAR classifies the Pressurizer Power Operated Relief Valves (PORVs) and their associated block

(isolation) valves as high/low pressure interfaces. The removal of the PORVs and block valves as high/low pressure interface components is a reduction in the PFSSD analysis methodology contained in Wolf Creek's post-fire safe shutdown analysis. However, the defense-in-depth measures provide reasonable assurance that a fire that does occur will be limited in severity and there is reasonable assurance that safe shutdown can be achieved.

#### 3.4 Changes to License Condition

The licensee states that the FSAR, Appendix 9.5B, contained the original fire hazards analysis for the station. Each fire area analysis contained a summary of the safe shutdown capability for a fire in that area. The safe shutdown summary was based on the original PFSSD analysis prepared during plant design. In each of the fire areas where one or both PORVs could spuriously open, it was stated that should the PORV fail open and should the block valve fail as is in the open position, the RCS would blow down to the PRT. It also stated that the control room operator would place the PORV in manual and close the PORV from the control room.

The licensee confirmed the proposed action to re-classify the pressurizer PORV and implement the LAR modifications will effectively make the safe shutdown summary statement in each fire area in the original FSAR true. The operation of the PORVs will not change. The changes will not affect the safety related function of the PORVs.

The licensee will revise their license as part of their approved FPP listed in their LAR, dated April 13, 2010, Attachment III, List of Regulatory Commitments.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Kansas State official was notified of the proposed issuance of the amendment. The State official had no comments. **[PM TO COMPLETE OR CONFIRM]**

#### 5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in Title 10 of the *Code of Federal Regulations* 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. There has been no public comment on such finding published in the *Federal Register* on **[DATE AND NUMBER TO BE PROVIDED BY PM]**. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments. **[PM TO COMPLETE OR CONFIRM]**

#### 6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance to ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the

amendment will not be inimical to the common defense and security or to the health and safety of the public. **[PM TO COMPLETE OR CONFIRM]**

Principal Contributors:

G. Cooper

D. Frumkin