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MEMORANDUM FOR: Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

FROM: William V. Johnston, Assistant Director
for Materials & Qualifications Engineering
Division of Engineering

SUBJECT: FIRE PROTECTION SAFETY EVALUATION REPORT - WOLF CREEK
NUCLEAR POWER PLANT, UNIT NO. 1

Plant Name: Wolf Creek Nuclear Power Plant, Unit No. 1
Docket Number: 50-482
Licensing Stage: OL
Responsible Branch: LB #1
Project Manager: G. Edison
Chemical Engineering Reviewer: P. Anand
Requested Completion Date: November 2, 1981
Review Status: 6 unresolved items

Enclosed is the Fire Protection Safety Evaluating Report.

We reviewed the Fire Protection Program in accordance with Appendix A to Branch Technical Position ASD 9.5-1 and Appendix R to 10 CFR Part 50.

We have not made a fire protection review site visit because the construction of the plant has not progressed to the level when such a visit would be meaningful.

The following are unresolved items:

- Our evaluation of the applicant's shutdown analysis concerning the adequacy of separation for fire protection and the alternate shutdown system for the control room is on-going.
- The applicant has not provided adequate information on the penetration seals to complete our review.
- We will require that certain cable trays and/or conduit supports to protected for one hour fire rating.
- We will require all control and sectionalizing valves to be either electrically supervised or be locked in the open position.

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- The applicant is evaluating the system to collect and contain lubricating oil for each reactor coolant pump for conformance to Appendix R requirements and will provide an engineered RCP Oil Collection System that will meet the requirements of para. C.2 or Reg. Guide 1.29. The results of this evaluation will be documented in a future amendment.

We will report on these unresolved items in a subsequent SER.

Except for the fire pump evaluation, this SER is identical to the Callaway SER which was issued to you on September 22, 1981.

William V. Johnston, Assistant Director
for Materials & Qualifications Engineering
Division of Engineering

Enclosure: As stated

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WOLF CREEK UNIT 1 EVALUATION REPORT

FIRE PROTECTION REVIEW

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10/27/82

ENCLOSURE
FIRE PROTECTION
SAFETY EVALUATION REPORT
BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
U.S. NUCLEAR REGULATORY COMMISSION
IN THE MATTER OF THE
KANSAS GAS & ELECTRIC COMPANY
WOLF CREEK GENERATING STATION
UNIT 1
DOCKET NO. 50-482

I. INTRODUCTION

We have reviewed the Wolf Creek Generating Station, Unit No. 1 Fire Protection Program Reevaluation submitted by the applicant by SNUPPS Letter dated April 15, 1977, and the revised SNUPPS fire hazards analysis dated June 29, 1981 and the FSAR site Addendum Rev. 4. The submittal was in response to our request to evaluate their fire protection program against the guidelines of Appendix A to Branch Technical Position ASB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and Appendix R to 10 CFR Part 50. We have not made the site visit yet because the construction of the plant has not progressed to the level where such a visit would be meaningful. As part of our review, we will visit the plant site to examine the relationship of safety related components, systems, and structures in specific plant areas to both combustible materials and to associated fire detection and suppression systems. The objective of our review is to ensure that in the event of a fire at Wolf Creek Unit 1 personnel and plant equipment would be adequate to safely shutdown the reactor, to maintain the plant in a safe shutdown condition, and to minimize the release of radio-active material to the environment. Our review included an evaluation of the automatic and manually operated water and gas fire suppression systems, and fire detection systems, fire barriers, fire doors and dampers, fire protection administrative controls, and the fire brigade size. Our consultants, Gage Babcock and Associates, Inc., participated in the review of the fire protection program and in the preparation of this safety evaluation report, and concur with our findings.

II. FIRE PROTECTION SYSTEMS DESCRIPTION AND EVALUATION

A. Water Supply Systems

The water supply system consists of two fire pumps separately connected to a buried, 12-inch pipe loop around the plant. There are two 100% capacity fire pumps. One pump is electric motor driven and the other is diesel engine driven. The pumps are located in circulating water screen house with the electric-fire pump separated by a fire-rated wall from the diesel pump. The fire pump and controllers are Underwriter's Laboratory listed. Controllers and pumps will be installed and tested in accordance with NFPA 20.

A separate jockey pump maintains the yard fire main pressure. If the fire main pressure drops, the electric motor driven fire pump will automatically start. The diesel engine driven fire pump will start automatically if the pressure drops to below the settings of the electric pump. Separate audible and visual alarms are provided in the control room for each pump to monitor pump operation, prime mover availability, power failure, and failure of a fire pump to start.

All valves in the fire protection outside yard loop water supply system are electrically supervised with alarms in the control room. All other valves are administrative control. We will require all control and sectionalizing valves that are not electrically supervised to be locked open and under a management supervisor program with start key control and periodic visual check of the valves.

The pumps take suction from a common wet pit sump in the

circulating water screen house. Two traveling water screens and bar grill are located at the inlet to sump serving the fire pumps. The greatest water demand for the fixed fire suppression systems is 2300 gpm and, coupled with 1000 gpm for hose streams creates a total water demand of 3300 gpm at a residual pressure of 80 psig. We find that the water supply system can deliver the required water demand with one pump out of service.

We will report on valve supervision in a subsequent safety evaluation report.

B. Sprinkler and Standpipe Systems

The automatic sprinkler systems and standpipe risers are connected to separate interior water supply headers. The interior headers are fed from each end through separate supply connections to the looped yard system with appropriate valves so that sections can be isolated to perform maintenance or to prevent a single break from impairing the entire distribution system. In addition, header and divisional valve arrangement is such that no single failure can impair both primary and backup fire protection systems protecting a single fire area. The water supply valves to the suppression systems are electrically supervised with alarms in the control room. In addition, the sprinkler systems have water flow alarms which alarm in the control room.

The automatic sprinkler system, e.g., wet pipe sprinkler systems, pre-action sprinkler systems, and water spray systems, will be designed to the recommendations of National Fire Protection Association (NFPA) Standards No. 13, "Standard for

the Installation of Sprinkler Systems," and No. 15, "Standard for Water Spray Fixed Systems."

The areas that are equipped with automatic water suppression systems include the following:

System

Area

Automatic wet-pipe sprinkler system

Turbine lube oil storage tank
Auxiliary boiler room
Turbine lube oil reservoir room

Condenser pit (area beneath the main condensers)

Dry waste compactor (radwaste building)

Access control area (control building)

Cable area above access control area

Vertical cable chases (auxiliary and control buildings)

Fire pump house

Automatic water spray system

Hydrogen seal oil unit

Main transformer

Auxiliary transformer

Station service transformer

ESF transformer

Automatic pre-action sprinkler

Fuel building railroad
bay

Lower cable spreading
room

Upper cable spreading
room

Cable trays at EL
1974' - 0", 2000' - 0",

and 2026' - 0" of the
auxiliary building

Diesel generator rooms

Area below turbine
generator operating
floor and mezzanine
floor

Manual hose stations are located throughout the plant to ensure that an effective hose stream can be directed to any safety related area in the plant. The standpipes are consistent with the requirements of NFPA 14, "Standard for the Installation of Standpipe and Hose Systems." Standpipes are 4- and 2-1/2-inch diameter pipe for multiple and single hose station supplies, respectively.

Based on our evaluation, we conclude that the sprinkler and standpipe systems are adequate, meet the guidelines of Appendix A, Sections C.3a and C.3d, and are, therefore acceptable.

C. Gaseous Fire Suppression Systems

A Halon total flooding system is used as the primary extinguishing agent in the ESF switchgear rooms, nonvital

switchgear and transformer rooms and switchgear rooms. The system is designed to produce a 5 to 10 percent Halon concentration with a soaking time of 10 minutes. The system is activated by cross-zoned ionization detectors. The concentration and soak time are adequate to extinguish potential fires in these areas.

The Halon suppression system is installed in accordance with the requirements of NFPA 12A, "Standard on Halogenated Fire Extinguishing Agent Systems - Halon 1301."

We have reviewed the concentration, soak times and the design criteria for the Halon Fire suppression system. Based on our evaluation, we conclude that the gaseous fire suppression systems are adequate, meet the guidelines of Appendix A, to BTP ASB 9.5-1 and are in accordance with the applicable portions of NFPA Standard 12A, and are therefore, acceptable.

D. Fire Detection Systems

The fire detection systems consist of ionization detectors, alarm control units associated electrical circuitry, electrical powersupplies and fire annunciator panels. There are 259 zones divided up into four alarm control units. The detection system operates on 24 V.D.C. The power supply to the alarm control units is 120 V.A.C. with 120 V. D.C. nonclass IE backup. The D.C. power system is backed by a battery supply. Automatic switchover to D.C. is provided in each alarm control unit in the event of A.C. power supply failure. All automatic suppression systems operate on 125 V. D.C. and the alarm control units serves as a distribution panel.

For area detection and alarm systems and for all detection for actuation of extinguishing systems, the signal is received by the alarm control units. Alarm and control functions are then initiated by the alarm control units with the appropriate annunciation in the control room. For valve supervision, extinguishing system discharge, and all other alarm and trouble signals generated by the local extinguishing system control panels, the signals feed through the alarm control unit multiplexer to the control room panel.

A multiplex transmitter/receiver units are installed with each alarm control unit. The four alarm control units are connected to a multiplex controller located in the fire protection control panel in the control room. The wiring between each T/R and the controller consists of two data loops. In safety-related areas, the fire detection and alarm system meets NFPA 72D, Class A. All other initiating device circuits are Class B.

The fire detection systems are installed according to NFPA 72D, "Standard for the Installation, Maintenance and Use of Proprietary Protective Signaling Systems."

We have reviewed the fire detection systems to ensure that fire detectors are adequate to provide detection and alarm of fires that could occur. We have also reviewed the design criteria of the fire detection system to ensure that they conform to the applicable sections of NFPA 72D.

III. OTHER ITEMS RELATED TO FIRE PROTECTION PROGRAMS

A. Fire Barriers and Fire Barrier Penetrations

Where safe shutdown equipment is enclosed by a fire barrier,

all walls, ceilings, floors, and associated penetrations which enclose the equipment have a minimum fire rating of three hours with the following exceptions: 1-1/2 hr. elevator doors, pressure, watertight and missile resistant doors, and equipment hatches in the auxiliary building. For fire areas that do not have a three-hour fire rated assembly, due to the installation of the preceding doors, each individual area was evaluated with respect to its fuel load, fire suppression and detection systems, and proximity to safe shutdown equipment to determine if fire rated assemblies provided are adequate for the areas affected and meet the guidelines in Section D. i. j. of Appendix A to BTP ASB 9.5-1. Based on this evaluation, we found the 1-1/2hour fire barriers for these areas acceptable. The applicant has agreed to provide 3-hour U.S. designs for all fire penetration seals used in the penetration cable trays, conduits, and piping which pass the penetration qualification tests including the time-temperature exposure fire curve specified by ASTM E-119, "Fire Test of Building Construction and Materials." The applicant has not provided adequate information on the penetration seals to complete our review. We will report on the penetration seals in a subsequent safety evaluation report.

In SHUPPS FSAR Revision 4 the applicant has agreed to provide one-hour fire rated barriers that will maintain circuit integrity for one hour for conduit and/or cable trays of one of two redundant divisions that are within 20 foot of each other as well as an area automatic sprinkler system. We are

concerned that the structural supports of these cable trays may collapse prior to the one hour fire rating of the cable trays. We will require that the cable tray supports be protected to achieve the same fire rating as the cable tray or conduit itself. We will report on this item in a subsequent safety evaluation report.

B. Fire Doors and Dampers

Fire doors in HVAC ducting penetration the fire barriers have a 3-hour fire resistance rating and fusible link operated. Personnel doors have the same rating as the barriers except as noted above under A - Fire Barriers and Fire Barrier Penetrations. In addition, the equipment hatchway in the auxiliary building is protected by an automatic sprinkler system water curtain. The test method and acceptance criteria for the fire doors and dampers was ASTM-152. The devices will carry the U.L. label with fire dampers installed in sleeves which are attached to the ductwork and supported by the walls.

Based on our review, we conclude that the fire doors and dampers are provided in accordance with the guidelines of Appendix A to BTP ASB 9.5-1, Section D.1.j. and are, therefore acceptable.

IV. EMERGENCY LIGHTING

The applicant has installed an 8-hour battery pack emergency lighting unit in all areas of the plant needed for operation of safe shutdown equipment and in access and egress routes. We conclude that, the emergency lighting meets the requirements

of Appendix A to BTP ASB 9.5-1, and, also the provisions of Section III.J. of Appendix R to 10 CFR Part 50 and is, therefore, acceptable.

V. FIRE PROTECTION FOR SPECIFIC AREAS.

A. Control Room

The control room complex is separated from all other areas of the plant by three-hour fire rated walls, ceiling/floors assemblies, floors and doors. All ventilation ducts penetrating these barriers have three-hour fire rated dampers. The control room complex peripheral rooms are constructed to provide a minimum fire rating of one hour. Smoke detectors are installed in these rooms which will alarm and annunciate in the control room.

All cabinets (which contain both trains of redundant safety-related conduit, cable, or wire required for safe shutdown), consoles, and the ventilation exhaust system within the control room have ionization fire detectors installed.

Automatic smoke detectors are provided at the ceiling of the control room. The main control room ventilation system can be remote manual isolated from the main control room as it has capability of being used as a smoke removal system. Automatic smoke detection is provided for the outside air intakes to the control room ventilation system.

Manual fire fighting is provided through the use of portable extinguishers and water hose reels.

Carpeting is to be installed in the control room with a flame spread rating of 50 and a smoke density of 180 when tested

according to ASTM E-84. We conclude that the carpeting meets our guidelines, and is, therefore, acceptable.

The floor of the control room contains nine cable trenches (3 inches deep), which continue up the height of the west wall in the control room. The trenches are covered by steel plates, with the vertical chases forced with sheet rock (not rated). A three-hour rated barrier is provided between each vertical cable chase. Access panels are provided for each chase as well as the steel covers on the trenches are removable. The vertical wall trays and the under-covers on the trenches containing cable from the upper cable spreading room to the control panels are provided with an automatically activated Halon-1301 fire protection system.

By letter, dated June 15, 1981, the applicant stated that an alternate shutdown system would be provided for the control room.

Based on our review and commitments, we conclude that the fire protection for control room meets the guidelines of Appendix A to BTP ASB 9.5-1 and is, therefore, acceptable.

B. Cable Spreading Room

The upper and lower cable spreading rooms are separated from the balance of the plant by three-hour fire-rated walls and floor/ceiling assemblies. Each room contains the cables from only one division. Three-hour fire rated fire dampers are provided for all ventilation ducts that pierce the walls.

All cable and piping penetrations through the fire rated barriers are fitted with 3-hour penetration seals. Exits are provided at each end of the room.

Automatic ionization type detection systems will annunciate in the main control room.

Manual-pull fire alarm stations are located near the exit doorways from this area. Hose stations and portable extinguishers are provided for protection of this fire area. Each room is also provided with an automatic pre-action sprinkler system with closed head nozzles. The system is designed per NFPA-13 with a design flow rate of 0.3 GPM per square foot. Total system flow is based on actuation of all heads over the most remote 3,000 square foot floor area.

The floor penetration in this area have watertight seals to prevent water damage in the control room below during firefighting operations.

Based on our evaluation, we conclude that, the fire protection for the cable spreading room meets the guidelines of Appendix A, Section D.3, to BTP ASB 9.5-1 and is, therefore, acceptable.

C. Containment and Reactor Building

The fire hazard potential associated with the reactor coolant pumps is discussed in Section D.

The reactor building is separated from adjacent buildings by 3-hour fire barriers. There are no physical boundaries enclosing localized fire hazards within the reactor building. An automatic detector is installed above each reactor coolant pump. Line type thermal detectors are also installed in all areas where cable trays are concentrated and ionization type

detectors are also installed in all areas where cable trays are concentrated and ionization type detectors are installed in the containment cooler ducts. The automatic detection system alarms are zoned in the control room.

Portable extinguishers and manual hose stations are permanently installed inside containment. At our request the applicant agreed to install two additional hose stations such that every hose station will be spaced no more than 100 feet from an adjacent hose station.

A fixed manually charged closed head sprinkler system is provided over the two cable tray penetration areas. The design density for the system is 0.3 gpm/square feet. The pressure and flow rate are based on all heads open in the most remote 1,000 square feet.

Based on our review, we conclude that the fire protection for the containment meets the guidelines of Appendix A to BTP ASB 9.5-1 and is therefore, acceptable.

D. Reactor Coolant Pumps

The system is designed to collect and contain lubricating oil for each reactor coolant pump. The oil collection tanks and piping are being designed to maintain their integrity following a safe shutdown earthquake. The applicant is evaluating the system for conformance to Appendix R requirements and will provide an engineered oil collection system that will meet the requirements of paragraph C.2 of Reg. Guide 1.29. The results of this evaluation will be documented in a future amendment.

E. Emergency Diesel Generator Rooms

Each of the emergency diesel generators is in its own protected room separated by walls, floor, ceiling and doors having a minimum fire rating of 3 hours.

All cable and piping penetration through the fire-rated barriers are fitted with 3-hour rated penetration seals.

The 550 gallon diesel fuel oil day tank is contained by a dike around the base of the tank and will hold 110% of the contents of the day tank with drains in a safe location.

Early warning fire detection is provided by infrared detectors. The detection system alarms locally and in the control room. Manual-pull fire alarm stations are located near the exit doorways.

An automatic preaction sprinkler system is provided for each area and is automatically charged by detector actuation. Heat vents in the roof are spring loaded to open when a thermal link is activated by the heat of the fire.

Based on our evaluation, we conclude that the fire protection for the diesel generator rooms meets the guidelines of Appendix A to BTP ASB 9.5-1 and is, therefore, acceptable.

F. Other Plant Areas

The applicant's Fire Hazards Analysis addresses other plant areas not specifically discussed in this report. We find that the fire protection for these areas are in accordance with the guidelines of Appendix A to BTP ASB 9.5-1, and are, therefore, acceptable.

VI. FIRE PROTECTION FOR SAFE SHUTDOWN CAPABILITY

By letter dated June 15, 1981 the applicant stated he has

installed an alternate shutdown system for the control room as a means of achieving and maintaining hot standby. Cold shutdown can be achieved and maintained from outside the control room by additional manual operator actions at local control sites. Our evaluation of the applicant's program to identify shutdown systems, the separation of such systems for fire protection, and the alternate shutdown system is on-going.

VII. ADMINISTRATIVE CONTROLS AND FIRE BRIGADE

The administrative controls for fire protection consists of the fire protection organization, the fire brigade training, the controls over combustibles and ignition source, the prefire plans and procedures for fighting fires and quality assurance. The fire brigade will be composed of five members per shift. To have proper coverage during all phases of operation, members of each shift crew will be trained in fire protection in accordance with our guidance including Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants." The applicant by letter dated June 17, 1981 has agreed to implement the fire protection program contained in the staff supplement guidance "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," dated August 29, 1977, including (1) fire brigade training, (2) control of combustibles, (3) control of ignition sources, (4) fire fighting procedures, and (5) quality assurance. The applicant will implement the plant administrative controls and procedures before fuel loading.

We conclude that, with the commitments, the size of the fire

brigade, the fire brigade equipment and the training will conform to the recommendations of the National Fire Protection Association, to Appendix A to BTP ASB 9.5-1, and to our supplemental staff guidelines and, therefore, are acceptable.

VIII. TECHNICAL SPECIFICATIONS

The applicant has committed to follow our Standard Technical Specifications. We find this acceptable.

IX. APPENDIX R STATEMENT

On May 23, 1980, the Commission issued a Memorandum and Order (CL 1-80-21) which states that: "The combination of the guidance contained in Appendix A to BTP ASB 9.5-1 and the requirements set forth in this rule define the essential elements for an acceptable fire protection program at nuclear power plants docketed for Construction Permit prior to July 1, 1976, for demonstration of compliance with General Design Criterion 3 of Appendix A to 10 CFR Part 50." On October 27, 1980, the Commission approved a rule concerning fire protection. The rule and its Appendix R were developed to establish the minimum acceptable fire protection requirements necessary to resolve certain areas of concern in contest between the staff and licensees of plants operating prior to January 1, 1979. The requirements set forth in Appendix R are being used as guidelines in the licensing of plants after January 1, 1979. On April 27, 1981, the Commission required that operating licenses issued after January 1, 1979, contain a condition requiring compliance with commitments made by an applicant and agreed to by the staff after differences

between the applicants' program and the guidelines set forth in Appendix A to BTP 9.5-1 and Appendix R to 10 CFR 50 have been identified and evaluated.

The applicant has not committed to meet the technical requirements of Appendix R to 10 CFR Part 50 or provide equivalent protection. We will condition the operating license to require the applicant to meet the technical requirements of Appendix R to CFR Part 50, or provide equivalent protection.

X. CONCLUSION

There are six unresolved fire protection items to be reviewed. These six items involve alternate shutdown system, protection of cable tray supports, oil collection system, separation for fire protection, valve supervision, and penetration seals. We will report our review of these six items in a subsequent safety evaluation report.