



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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Docket Nos: 50-369
50-370

MEMORANDUM FOR: D. Vassallo, Assistant Director
for Light Water Reactors, DPM

FROM: V. Benaroya, Acting Assistant Director
for Plant Systems, DSS

SUBJECT: FIRE PROTECTION SAFETY EVALUATION REPORT - MCGUIRE
NUCLEAR STATION, UNIT NOS. 1 AND 2

Plant Name: McGuire Nuclear Station, Units 1 & 2
Docket Numbers: 50-369/370
Licensing Stage: OL
Milestone Number: N/A
Responsible Branch: LWR-2
Project Manager: R. Birkel
Requested Completion Date: November 17, 1978
Review Status: Complete

The Auxiliary Systems Branch has completed its review of the Safety Evaluation Report for McGuire Nuclear Station, Unit Nos. 1 and 2, Fire Protection Program. The Fire Protection Program was reviewed in accordance with Appendix A to Branch Technical Position ASB 9.5-1.

The licensee has committed to implement emergency shutdown procedures in addition to improvements under way or planned for the plant fire Protection Program by commercial operation of Unit No. 1 to assure safe cold shutdown without reliance on the cable spreading room or the control room. The applicant has committed to install an independent safe shutdown system (SSS) at a later date. We will review the final design of the SSS prior to its operation. Based on our review, we find that the licensee's fire protection program with improvements already made by the licensee, is adequate for the present and with the scheduled modifications will meet the guidelines of Appendix A to Branch Technical Position 9.5-1, and meets General Design Criterion 3 and is, therefore, acceptable.

V. Benaroya, Acting Assistant Director
for Plant Systems
Division of Systems Safety

Enclosure:
As stated

cc: See next page

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MCGUIRE 1 SAFETY EVALUATION REPORT
FIRE PROTECTION REVIEW
UNIT NOS. 1 AND 2

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McGUIRE UNIT NOS. 1 AND 2
FIRE PROTECTION PROGRAM EVALUATION REPORT

1. INTRODUCTION

We have reviewed the McGuire fire protection program and fire hazards analysis submitted by the applicant. The submittal was in response to our request to evaluate his fire protection program against the guidelines of Appendix A to 10CFR 50.5-1, "Guidelines for Fire Protection for Nuclear Power Plants." As part of the review, we visited 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 overall objective of our review of the McGuire Nuclear Plant fire protection program was to ensure that in the event of a fire at the facility, the units would maintain the ability to safely shutdown and remain in a safe shutdown condition and to minimize the release of radioactivity to the environment.

Our review included an evaluation of the automatic and manually operated water and gas fire suppression systems, the fire detection systems, fire barriers, fire doors and dampers, fire protection administrative controls and fire brigade training, and plant fire protection technical specifications.

Since Unit 1 and Unit 2 are of the same design, except where noted, the comments made in this report apply to both units.

II. FIRE PROTECTION SYSTEMS DESCRIPTION

A. Water Suppression Systems

The fire water system is common to both units and consists of three full capacity 2500 gpm motor driven pumps two 200 gpm pressure maintenance pumps (jockey pump) with a 5000 gallon pressure surge tank, a yard loop with sectionalizing post-indicator isolation valves.

Power to fire pump A is from Unit 2, 2TB switchgear; power to fire pump B is from Unit 1 1TD switchgear; and power to fire pump C is from the 44 Kv substation independent of the McGuire Station auxiliary power system.

The jockey pumps take suction from the condenser circulating water system, and the fire pumps take suction from Lake Newman. All pumps are installed in accordance with applicable NFPA guidelines. A redundant starting scheme is used for the three main fire pumps. In the event of a fire, a drop in line pressure actuates a set of staggered set point pressure switches so that if the first pump fails to start, the second and third pumps will sequentially start automatically. Separate alarms monitoring pump running, drive availability, or failure to start are provided in the control room for each pump.

The fire pumps are located in the seismic Category 1 intake structure and separated by three hour fire rated barriers from the other pumps in that structure. Portions of the fire suppression system piping in the vicinity of safety related equipment or used to protect such equipment is designed to meet seismic conditions.

The automatic sprinkler system and standpipe system are fed by a main yard loop serving both Unit 1 and Unit 2 with multiple connections to interior fire protection systems header, e.g., the auxiliary building, turbine building, service building and reactor building. Each sprinkler system and manual hose station has an independent connection to the fire protection feeder, therefore a single failure cannot impair both the primary and backup fire protection systems.

Post indicator valves are provided to isolate sections of the fire loop for maintenance or repair. Valves in the fire protection system which are not electrically supervised, with indication in the control room, will be locked in normal operating position and checked periodically.

The automatic sprinkler systems, e.g., wet sprinkler system, pre-action sprinkler systems, deluge and water spray systems, shall comply to the requirements of NFPA Standard No. 13, "Standard for Installation of Sprinkler Systems," and NFPA Standard No. 15, "Standard for Water Spray Fixed System."

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. These systems are consistent with the requirements of NFPA Standard No. 14, "Standpipe and Hose System for Sizing, Spacing, and Pipe Support Requirements."

Areas that have been equipped or will be equipped with water suppression systems are:

- (a) Cable spreading room (Manual Fog System)
- (b) RHR pump rooms and adjacent corridor area (automatic)
- (c) Motor driven auxiliary feedwater pump room (automatic)
- (d) Centrifugal charging pump rooms (automatic)
- (e) Nuclear service water pump rooms (automatic)
- (f) Component cooling water pumps rooms (automatic)
- (g) Reactor coolant pump (remote manual)
- (h) Containment Annulus (remote manual)
- (i) Pipe corridor @ EL 725' (automatic)
- (j) Battery room open area - east and west ends (automatic)

We have reviewed the design criteria and bases for the water suppression systems and conclude that these systems meet the guidelines of Appendix A to Branch Technical Position 9.5.1 and are in accord with the applicable portions of the National Fire Protection Association (NFPA), Codes, and are, therefore, acceptable.

B. Gas Suppression System

A Halon 1301 suppression system is installed in the following areas:

- (a) Emergency diesel generator rooms;
- (b) Steam driven auxiliary feedwater pump room.

The Halon 1301 system for the diesel generator rooms is automatically actuated by fixed temperature detectors. Actuation of this system provides alarms and annunciate in the main control room. The ventilating systems for these rooms shutdown automatically in the event of actuation of the Halon system, thus, isolating the diesel rooms.

The Halon suppression systems are designed and installed according to NFPA Standard No. 12A, "Halogenated fire extinguishing agent systems - Halon 1301." We have reviewed the design criteria and basis for these fire suppression systems. We conclude that these systems satisfy the provisions of Appendix A to Branch Technical Position 9.5.1 and are, therefore, acceptable.

C. Fire Detection Systems

The fire detection system consists of the detectors, associated electrical circuitry, electrical power supplies, and the fire annunciator panel. The types of detectors used at the McGuire Nuclear Plant are ionization (products of combustion), and thermal (heat sensors). The system is continuously supervised with a Class B supervised system. The central supervising station is provided with two sources of power; primary (ac) and secondary (dc-inverter power). A trouble alarm is initiated and annunciated in the control room in the event of any sensor or circuit failure.

Fire detection systems will give audible and visual alarm and annunciation in the control room. Local audible and/or visual alarms are also provided.

At our request, the licensee agreed to install additional smoke detectors in the immediate area of the small exhaust fan servicing the control panels in the main control room. Smoke detectors will also be installed in each battery cell room, the steam driven auxiliary feed pump room and the peripheral rooms of the main control room to provide early notification of a fire.

The fire detection systems have been installed or will be installed according to NFPA No. 72D, "Standard for the Installation, Maintenance, and Use of Proprietary Protection Signalling Systems."

We have reviewed the fire detection systems to ensure that fire detectors are located to provide detection and alarm of fires that could occur. We have also reviewed the fire detection systems design criteria and bases to ensure that it con-

forms to the applicable sections of NFPA No. 72D. We conclude that the design and the installation of the fire detection systems with the additional detectors to be installed, meet the guidelines of Appendix A to Branch Technical Position ASB 9.5-1, and are therefore, acceptable.

III. OTHER ITEMS RELATING TO THE STATION FIRE PROTECTION PROGRAM

A. Fire Barriers and Fire Barrier Penetrations

All floors, walls, and ceilings enclosing separate fire areas are rated at a minimum of 3-hour fire rating. At our request, the applicant has conducted a full scale fire test for the wall separating the cable rooms along column line 56 in the auxiliary building, E1 750. As a result of the fire test the applicant has agreed to modify this barrier by installing a fire proofed angle iron along the junction of the barrier and the ceiling. The main control room area contained peripheral rooms which are located within the main control room 3-hour fire barrier. These peripheral rooms will be provided with detectors and alarms and one-hour rated ceilings and fire doors.

Barriers having 1 1/2 hour fire rating will be provided between redundant component cooling pumps. The barriers will extend from floor to ceiling and 3' beyond each pump.

In the area where the motor driven auxiliary feedwater pumps and remote shutdown panel are located, the licensee has agreed to

provide 1/2 hour fire barriers to protect the overhead instrumentation and control cables for the turbine driven pump which pass through this area. In addition the remote shutdown panel will be protected on four sides from an exposure fire with a 1/2 hour barrier.

The licensee has provided documentation to substantiate the fire rating of the 3-hour barriers, penetration seals used in the penetrations for cable trays, conduits, and piping.

B. Fire Doors and Dampers

We have also reviewed the placement of the fire doors to ensure that fire doors of proper fire rating have been provided.

All doors which separate safety related redundant divisions including doors separating the turbine building from any safety related equipment room, will be locked and/or alarmed in the control room.

Penetrations through rated barriers are sealed to provide fire resistance equivalent to the barrier itself. Ventilation penetrations through barriers are protected by standard fire door dampers. The licensee has provided NRC with necessary information to demonstrate that the fire dampers can provide a fire rating of three hours.

The applicant has further agreed to provide fire proofed supports for those HVAC ducts in safety related areas to ensure the integrity of the barrier penetration between the duct work, including the damper, and the fire barrier. The fire proofed duct support will be located at a distance no greater than 5 feet from the barrier.

We conclude that the fire barriers, barrier penetrations, fire doors and dampers are provided in accordance with the guidelines of Appendix A to Branch Technical Position ASB 9.5-1 and are, therefore, acceptable.

C. Armored Electrical Cable

The power and control cable used in McGuire is insulated with ethylene propylene rubber (EPR) then encased in a steel interlocked armor jacket or a served wire armor jacket. The cable outside the containment has an outer PVC jacket over the metal armored jacket. The cable inside containment has the outer PVC jacket removed.

The applicant has conducted tests which demonstrate that no fire propagation from cable to cable or tray to tray occurs as a result of an electrically initiated fire. In addition, the cable used at McGuire passes the current IEEE 383 Flame Test. However, because of the PVC on the outside of the armored cable, we have required appropriate fire protection measures in the cable spreading room, as discussed in Section V of the report.

IV. Safe Shutdown System

The applicant will install, at a later date, a completely independent Standby Shutdown System (SSS) which will be located in a separate structure remote from the existing plant facilities. The system will incorporate its own power supply and instrumentation. The SSS will provide a means of independently bringing the unit to a safe hot standby condition (assuming loss of redundant functions in such areas as the cable spreading room, control room or the battery room common area) and maintain this condition until damage control measures can be instituted to bring the unit to a cold shutdown condition. Repair procedures and operating procedures for cold shutdown following a fire incident will be prepared prior to plant start-up with the materials required to make the necessary repairs on site. The licensee will be able to make repairs and achieve cold shutdown within 72 hours; however, the SSS is capable of extending this time significantly longer. Since the SSS will be installed after initial fuel loading, we required and the applicant has agreed to establish and implement, by initial fuel loading, emergency procedures to assure safe plant shutdown in the event of a damaging fire in the cable spreading room or the control room.

We will review the final design of the SSS when it is available. We have reviewed the design concept of the SSS and conclude that it will be capable of achieving a safe hot standby condition and meets the guidelines of Appendix A to BTP ASB 9.5-1 and is therefore acceptable.

V. Fire Protection for Specific Areas

A. Cable Spreading Room

Each unit has a cable spreading room separated from each other by three hour fire rated walls. The walls, floors and ceiling in each room are designed to have a fire rating of three hours. At present there is no fixed automatic system installed. Primary fire protection is provided by portable fire extinguisher and hose stations. Smoke detectors are provided that will initiate a local alarm and audible and visual alarm in the control room.

All power control or instrumentation cable pass the current IEEE No. 383 Flame Test. All cable within each cable spreading is encased in a galvanized steel, interlocked armor jacket and covered with a polyvinyl chloride (PVC) jacket. All cables in this room are routed in cable trays. Aisle separation and overhead clearance is provided for access for fire fighting operation; however we were concerned that the large quantity of cable with the PVC jacket constituted a significant fire load and that an exposure fire could disable the redundant safety related cable tray of one unit. At our request, the licensee has agreed to provide a manually initiated fixed waterspray (fog/mist) system for each cable room and that the system will provide a level of open spray heads at the ceiling and an additional level below the lowest cable trays throughout both rooms.

The applicant will provide an independent safe shutdown facility (see Section IV). As discussed previously, since the SSF is proposed for installation at a later date, the applicant will establish and implement by initial fuel loading emergency procedures to assure safe plant cold shutdown in the event of a damaging fire in the cable spreading room or the control room.

We have reviewed the licensee's fire hazards analysis and fire protection provided for the cable spreading room and consider that appropriate fire protection and emergency shutdown procedures have been provided and conform to the provisions of Appendix A to BTP 9.5-1 and are therefore, acceptable.

B. Battery Room Areas (Fire Area 13)

There is a large concentration of overhead cable trays at the east and west ends of the battery room open area. The cable trays at each end belong to the same safety division of each unit. The battery cell rooms are individually separated by 3-hour fire barriers, therefore it is unlikely that a single fire could affect all the battery rooms at the same time and prevent safe shutdown of the plant. However, because of the heavy concentration of fire load in this area we requested and the applicant agreed to upgrade the existing fire dampers in the ventilation system to 3 hours. The applicant also agreed to provide a sprinkler system to protect the cable trays from an exposure fire.

C. Fire Protection Inside Containment

The major fire hazard in the containment is the lubrication oil contained in the reactor coolant pumps. Each reactor coolant pump is provided with an oil collection system around the upper and lower oil pots to contain any oil leakage and direct it to piping which goes to a drain tank. In addition a closed head sprinkler system is provided for each pump. The control valve for this system is manually operable from the control room. Ionization and fixed temperature detectors around the pumps alarm and annunciate in the control room.

Instrumentation cables within containment are encased in galvanized steel interlocked armor without a PVC jacket so that propagation of an electrically initiated fire is precluded.

Two containment auxiliary carbon filter units are located in the lower containment compartment. Each unit is protected by a fixed manual water spray system. Hose stations are provided as secondary protection throughout containment.

The annulus which contains armored cable penetrations without PVC jacketing is protected by a fixed manual extinguishing system with detection by both ionization and rate of rise heat detector. The area is not readily accessible during normal plant operation. When containment access is possible, the area hose station and portable extinguisher (located outside containment) may be used for manual fire fighting.

We have reviewed the applicant's Fire Hazards Analysis for areas inside containment and conclude that appropriate fire protection has been provided and is acceptable.

D. RHR Pump Rooms

There are no fire doors installed on the three-hour fire barriers of each RHR pump rooms. Access for manual fire fighting is very limited by two open spiral stairways from the level above. At our request, the licensee has agreed to extend the sprinkler system in each RHR pump room to cover the adjacent corridor area where an exposure fire may occur and threaten the RHR pumps. We have reviewed the applicant's Fire Hazards Analysis for the RHR pump rooms and conclude that appropriate fire protection has been provided and is acceptable.

E. Other Plant Areas

The licensee's Fire Hazards Analysis addresses other plant areas not specifically discussed in this report. The licensee has committed to install additional detectors, portable extinguishers, hose stations, and some additional emergency lighting as identified in the licensee's installation schedule. We find these areas with the commitment made by the licensee to be in accordance with the guidelines of Appendix A of BTP 9.5-1, and the applicable sections of the National Fire Protection Association Code and are therefore acceptable.

VI. ADMINISTRATIVE CONTROLS

The administrative controls for fire protection consists of the fire protection organization, the fire brigade training, the controls over combustibles and ignition sources, the prefire plans and procedures for fighting fires.

In response to Appendix A to Branch Technical Position ASB 9.5-1, the licensee described briefly those procedures and controls that were in existence at that time.

The licensee has agreed to revise his administrative controls and training procedures to follow supplemental staff guidelines contained in "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," dated 6/14/77, and implement them by initial fuel loadings for the following activities;

- (a) Fire Brigade Training;
- (b) Control of Combustibles;
- (c) Control of Ignition Sources; and
- (d) Fire Fighting Procedures
- (e) Quality Assurance

The plant fire brigade of at least five members is organized to provide immediate response to fires that may occur at the site. Spare air cylinders and recharge capability are provided to satisfy the guidelines of Appendix A to Branch Technical Position ASB 9 5-1.

The plant fire brigade will also be equipped with breathing apparatus, portable communications equipment, portable lanterns, and other necessary fire fighting equipment.

The fire fighting brigade participates in periodic drills. Liaison between the plant fire brigade and the local fire departments has been established. The local fire departments have been on plant tours and have also been involved in training sessions with the plant fire brigade.

We conclude that the fire brigade equipment and training conform to the recommendations of the National Fire Protection Association, Appendix A to Branch Technical Position 9.5-1 and supplemental staff guidelines and are, therefore, acceptable.

VII. TECHNICAL SPECIFICATIONS

We have reviewed the currently approved Technical Specifications for McGuire Units Nos. 1 and 2 and find that the specifications are in accordance with our Standard Technical Specifications for fire protection systems. Following the implementation of the modifications of fire protection systems and administrative controls resulting from this review, the Technical Specifications will be modified accordingly to incorporate the limiting conditions for operation and surveillance requirements to reflect these modifications.

VIII. CONCLUSIONS

During the course of our review we have reviewed the licensee's submittals and his responses to our requests for additional information. In addition, we have made a site visit to evaluate the fire hazards that exist in the McGuire Nuclear Plant and the design features and protection systems provided to minimize these hazards.

The licensee has proposed to make many modifications to improve the fire resistance capability for fire doors, dampers, fire barriers and barrier penetration seals.

The applicant has also proposed to install additional sprinkler systems for areas such as the cable spreading rooms, battery room area, RHR pump room area, and various other areas. To ensure that fires can be detected rapidly and the plant operators informed promptly, additional detectors will be installed in various areas of the plant.

In addition the applicant has committed to provide a completely independent safe shutdown system to insure the shutdown capability for McGuire Nuclear Plant. Until the SSS is installed, the applicant will establish an emergency shutdown procedure to bring the plants to safe cold shutdown condition in the event of a damaging fire in the cable spreading room or the main control room.

The applicant has committed to making all improvements prior to initial fuel loading of Unit 1 with the following exceptions which will be implemented prior to commercial operation of Unit 1:

1. Extension of the RHR pump room sprinkler system to protect the corridor connecting the pump rooms.
2. Automatic sprinklers installed to protect the cable tray stacks at the east and west ends of the battery room from an exposure fire.
3. Fire doors and dampers installed in penetrations in room 807 and 820 on E1 750 of the Auxiliary Building which are adjacent to safety related equipment area.
4. Fire doors, dampers and the 1 1/2 hour rated ceilings for the peripheral rooms within the control complex.

We have reviewed the applicant's schedule and find it acceptable.

We find that the Fire Protection Program for the McGuire Nuclear Plant with the improvements already made by the licensee, is adequate for the present and, with the scheduled modifications, will meet the guidelines contained in Appendix A to Branch Technical Position 9.5-1 and meets the General Design Criteria 3 and is, therefore, acceptable.