UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 19 1984

MEMORANDUM FOR: Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

FROM: William V. Johnston, Assistant Director
Materials, Chemical & Environmental Technology
Division of Engineering

SUBJECT: FIRE PROTECTION SUPPLEMENTAL SAFETY EVALUATION REPORT - BYRON STATION, UNITS 1 & 2

Plant Name: Byron Station, Units 1 & 2
Docket Nos.: 50-454/455
Licensing Stage: OL
Responsible Branch and Project Manager: LB #1; L. Olshan
CMEB Reviewer: D. J. Kubicki
Review Status: Two Open Items

We performed our fire protection site visit between July 12 and 15, 1983. Also, Region III conducted an inspection on December 21-23, 27-30, 1983. As a result, we reached several agreements with the applicant concerning the adequacy of the fire protection program. We also expressed a number of concerns pertaining to previous applicant commitments and the degree of compliance with our fire protection criteria. These issues were delineated in our trip report of July 26, 1983 and in NRC Inspection Report (50-454/83-62; 50-455/83-42). In a subsequent Task Interface Agreement, Region III referred a number of unresolved inspection items to NRR for resolution.

By letters dated September 20 and December 14, 1983, June 20, July 6, August 20, and September 19, 1984 and in Amendments No. 3 and 4 to the Byron Fire Protection Report, the applicant provided additional information.

Attached is our evaluation and the resolution of the identified deviations; the proposed license condition for the fire protection program; and our SALP input. This evaluation closes out the issues that were referred to us for resolution by the above referenced Task Interface Agreement.

Contact: D. J. Kubicki
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The review of the applicant's Safe Shutdown Analysis and the Alternate Shutdown System is open. The Supplemental Safety Evaluation Report for these issues will be provided by the Auxiliary Systems Branch.

William V. Johnston, Assistant Director
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Attachments: As stated

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Chemical Engineering Branch/Fire Protection Section
Supplemental Safety Evaluation Report
Byron Station, Units 1 & 2
Docket Nos. 50-454/455

9.5 Other Auxiliary Systems

9.5.1 Fire Protection Program

9.5.1.1 General

Our fire protection site audits were conducted between July 12-15, December 21-23 and December 27-30, 1983. As a result, we reached several agreements regarding the adequacy of the fire protection program. In addition, we expressed a number of concerns/questions pertaining to previous applicant commitments; the justification for particular fire protection designs; and the degree of compliance with our fire protection criteria.

By letters dated September 20 and December 14, 1983, June 20, July 6, August 20, 1984 and Amendments No. 3 and 4 to the Byron Fire Protection Report, the applicant provided additional information.

9.5.1.4 General Plant Guidelines

Building Design

In our Safety Evaluation Report (SER), we evaluated the construction of fire area boundaries. During our inspections, we observed that in several areas of the plant, structural steel forming a part of or supporting fire barriers was unprotected. We were concerned that a fire could produce elevated room temperatures sufficiently high to cause the failure of such elements, resulting in the loss of integrity of the fire barrier and damage to components/cables of redundant shutdown divisions located within the same floor elevation or on vertically adjoining elevations.

By letter dated August 20, 1984, the applicant identified the location of all safety-related areas where unprotected steel structural elements exist, and provided the results of an analysis on the consequences of the failure by fire of those elements, on the ability to safely shutdown the plant. In those areas where the failure of structural steel might have caused the loss of redundant shutdown divisions, the applicant committed to protect the steel with a listed "fireproofing" material that is rated at 2 hours as defined by the test method of ASTM E-119. This protection is commensurate with the hazard in these locations with conservative margin and provides us with reasonable assurance that the steel will retain its integrity until any exposure fire is suppressed by the plant fire brigade. In those areas where failure of structural steel would not result in damage to redundant shutdown divisions, the steel is not coated with a fireproofing material. Because the failure of such steel has no safety consequences, we find this acceptable. We, therefore, conclude that the lack of protection of structural steel in certain areas represents an acceptable deviation from the guidelines of Section C.5.a.(1) of BTP CMEB 9.5-1.

During our inspections, we observed that the installation of fireproofing for some structural steel elements was incomplete. By letter dated September 20, 1983, the applicant committed to complete most of this work prior to exceeding 5% power. Completion of this work prior to low power operation is not necessary because only small quantites of radionuclide inventory will exist in the reactor coolant system and therefore will not affect the health and safety of the public. Where protection of structural steel is incomplete, the applicant committed to implement the action statements of the technical specifications. With the implementation of this commitment, this aspect of the fire protection program will conform to the guidelines in Section C.5.a. of BTP CMEB 9.5-1 and is, therefore, acceptable. We also observed several locations within the Auxiliary Building where floor/ceiling structural assemblies such as at open stairways were not completely fire rated. We were concerned that if a fire occurred on one elevation, smoke, flame and hot gases would propagate upward and damage redundant shutdown systems in vertically adjoining fire zones. In Amendment No. 3 to the Fire Protection Report, the

applicant identified all locations where such physical features exist and proposed specific fire protection modifications to protect at least one shutdown division. In some locations, such as between elevations 346 feet and 364 feet in the Auxiliary Building, the applicant committed to install an automatic sprinkler system around the unprotected openings. This protection, coupled with the remaining fire rated floor construction and sealed penetrations provides us with reasonable assurance that the effects of a fire will be largely confined to one elevation and, therefore, one division will remain free of fire damage.

In other locations where protection of floor openings was not practicable, such as in the floor between elevations 364 feet and 383 feet of the Auxiliary Building, the applicant committed in Amendment 3, to protect one shutdown division by either a 1-hour fire-rated barrier or a 3-hour rated barrier where signficant quantities of combustibles were present. Therefore, if vertical fire propagation occurred, one shutdown division would be free of damage.

In the remaining areas where complete, fire-rated floor ceiling assemblies were not provided, the fire hazards are negligible and any combustible material is widely dispersed. The areas are completely protected by an automatic fire detection system, partial fire suppression systems over significant hazards, and portable fire extinguishers and manual hose stations. Openings in the floor/ceiling are protected by noncombustible seals and hatches such that a continuous barrier exists between redundant divisions (such as between elevations 414 feet and 426 feet in the Auxiliary Building). We, therefore, have reasonable assurance that until fire extinguishment, the floor/ceiling assembly will confine the fire effects so that one shutdown division reamins free of damage. We, therefore, conclude that the absence of continuous, 3-hour fire-rated barriers between vertically adjoining fire areas, as delineated in Amendment No. 3 to the Fire Protection Report is an acceptable deviation from the guidelines in Section C.5.a.(1) of BTP CMEB 9.5-1.

By Amendment No. 3 to the Fire Protection Report, the applicant committed to seal fire barrier penetrations with material having a fire resistance rating comparable to the ratings of fire walls and floor/ceiling assemblies. This necessitates that sealant material be installed to an appropriate depth consistent with its U.L. listing. During the site audit, we observed that sealant material was installed in the plant in thicknesses greater than the depth of the fire barrier. We were concerned that with the sealant material in this configuration, the fire rating of the penetration seals as installed in the plant, are not equivalant to the rating of the structural assembly. Although the sealant is installed in greater thickness than the fire barrier, this thickness is necessary to achieve the required fire rating. The material is installed in a metal sleeve which is not prone to fire damage and will assure that the material stays in place until subjected to elevated temperatures in a fire. This configuration was tested in accordance with the test method IEEE Standard 634. This test demonstrated that the seal would prevent fire propagation for 3-hours when exposed to an ASTM E-119 fire exposure. Therefore, we conclude that the installation of the penetration seal in this configuration is acceptable.

In addition, we were concerned that the acceptance criteria for the penetration qualification test was in excess of the 325°F maximum temperature permitted on the unexposed side by ASTM E-119, "Fire Test of Building Construction and Materials." The applicant stated that the acceptance criterion used was a maximum temperature rise on the unexposed surface of the fire stop of 325°F and that the maximum temperature rise on the unexposed side on the outer cable covering was 700°F. Actual fire test results conducted on the penetration seals demonstrated that the 325°F temperature criterion was exceeded on the unexposed side in a narrow zone along the penetration. We confirmed in a plant walkdown that no sensitive electronic components or combustible material exist in this zone. Therefore, we have reasonable assurance that conductive heat, smoke and hot gases will not be transmitted through the penetration assembly and damage shutdown-related systems on the unexposed side of the fire barrier.

During our site audit, we observed that the installation of some penetration seals was incomplete. By letter dated September 20, 1983, the applicant committed to complete most of this work by fuel load. Where the installation of seals is incomplete, the applicant has committed to implement the action statement of the technical specifications. With the implementation of this commitment, this aspect of the fire protection program will conform to the guidelines in Section C.5.a of BTP CMEB 9.5-1 and is, therefore, acceptable.

During our audit, we observed that bus ducts pass through certain fire barriers which separate redundant shutdown-related systems. We were concerned that in the event of a fire of significant magnitude, the bus ducts would fail, causing fire to propagate to adjoining plant locations and damage both shutdown divisions. However, by letter dated December 14, 1984, the applicant committed to install a fire-rated sealant within bus ducts at the point where they penetrate walls which separate redundant shutdown divisions. The rating of the sealant will be equal to the fire rating of the wall it protects. This protection provides us with reasonable assurance that fire-propagation through the bus ducts will not occur, and therefore, we find this acceptable.

In the Fire Protection Report, the applicant described the doors that are provided for access through fire barriers. Certain doors are Underwriters Laboratories (U.L) listed. Others are not listed because the particular configuration found in the plant has not been subjected to a standard fire test. However, these doors are constructed of the same materials and to the same standards as the listed doors and the installation of the door assembly in the fire barrier is identical to U.L. listed doors. The deviations from tested configuration were the result of modifications made to satisfy other regulatory guidance, such as plant security. It is our opinion that these modifications will not significantly diminish the fire resistance of these doors. During our site audit, we observed no unmitigated fire hazard that would result in the loss of integrity of the door during a fire exposure. We therefore conclude that the absence of a U.L. listing on those doors identified in the applicant's Fire Protection Report is an acceptable deviation from the guidelines in Section C.5.a.(5) of BTP CMEB 9.5-1.

During our audit, we observed that the door for the Auxiliary Feedwater Pump Room on elevation 383 feet did not have a U.L. label and were concerned that it was not listed. By letter dated September 20, 1983, the applicant confirmed that this was a U.L. listed door. This door is in conformance with our guidelines and is, therefore, acceptable.

Control of Combustibles

In our SER, we were concerned that the protection of hydrogen lines in safety related areas would not meet the guidelines of Section C.5.d.(2) of BTP CMEB 9.5-1. However, in the Fire Protection Report the applicant committed to comply with these guidelines. An excess flow valve has been provided at the hydrogen gas storage facility, designed to limit hydrogen concentrations in areas affected by a line break not to exceed 2 percent. Also, the 1-inch hydrogen supply pipe that is routed through the Auxiliary Building is designed to seismic category 1 requirements between the Volume Control Tank and the control valve, and is seismically supported throughout the building. This protection conforms with the above referenced guidelines and is, therefore, acceptable.

During our site audit, we observed several locations in the Auxiliary Building where seismic supports were incomplete. By letter dated September 20, 1983, the applicant confirmed that this work is now complete. This item is considered closed.

Ventilation

During our site audit, we observed that several fire dampers were installed in a "ganged" configuration, such as in the diesel generator room exhaust ducts. We were concerned that this configuration is not consistent with the listing of the damper by U.L. By letters dated September 20 and December 14, 1983, the applicant confirmed that no individual damper in a ganged configuration has dimensions greater than the largest damper tested and listed by U.L. This is consistent with our guidelines, and therefore is acceptable.

Lighting and Communication

During our inspection, we discovered 8-hour battery powered emergency lighting units were not provided per Section C.5.h.(1) of BTP CMEB 9.5-1 in areas where safe shutdown functions are to be performed, and their access paths. By letters dated September 20, 1983, June 20, 1984 and in Amendment No. 3 to the Fire Protection Report, the applicant committed to install additional 3-hour battery powered lighting units. All areas where manual shutdown related activities are to be performed were delineated. Travel routes to these areas were also identified. 8-hour battery powered lighting units were provided for these locations. A plant walkdown was then conducted by the station technical staff to confirm that the level of illumination was sufficient to perform the shutdown function. The above analysis and related modifications provides us with reasonable assurance that adequate emergency lighting is available and is, therefore, acceptable.

In our SER, the location of the repeaters used in conjunction with the emergency radio system was not resolved. We were concerned that redundant repeaters would be located in close proximity to one another, and would both be lost during a single fire event. By letter dated June 17, 1983, the licensee committed to provide a third repeater, located remote from the original two. During our site audit, we confirmed that the third repeater was located so as not to be damaged by a single fire event. However, the installation of the repeater was not complete. By letter dated September 20, 1983, the applicant confirmed that the work had been completed. Based on this information, this item is now considered resolved.

Fire Detection and Suppression

Fire Detection

During our inspections, we observed that in some locations the detection systems were adversely affected by features such as physical obstructions, air pockets, and high room ventilation rates. We were concerned that because of these features individual fire detections would not function as designed, resulting in delayed alarm and fire suppression. In Amendment No. 4 to the Fire Protection Report, the applicant provided the results of a complete renalaysis of the fire detection system to the guidelines of NFPA Standard No. 72E. Where items of nonconformance were observed, the applicant committed to install additional detectors or to modify the system to bring it into conformance. With the implementation of these commitments, the fire detection system will be in conformance with NFPA Standard No. 72E, and Section C.6.a.(3) of BTP CMEB 9.5-1, and is, therefore, acceptable.

Fire Protection Water Supply System

During our site audit, we observed that the installation of the electric motor driven fire pump did not comply with NFPA Standard No. 20, which is not consistent with the applicant's commitments in the Fire Protection Report. In Amendment No. 4 to the Fire Protection Report, the applicant provided the results of a complete re-analysis of the fire pumps and related equipment to NFPA 20. With the following two exceptions, the applicant committed to modify the design to bring it into compliance. The work will be done before exceeding 5% power. Implementation of the modifications, described in Amendment No. 4, before low power operation is not necessary because only small quantities of radionuclide inventory will exist in the reactor coolant system and, therefore, will not affect the health and safety of the public.

1) The low voltage control circuit for the pump controller will not be supplied from a stepdown control circuit transformer as specified by NFPA 20. The applicant's design has the control circuit powered from the plant 125V DC system. It is our opinion that this design is more reliable because the source is safety-related.

2) A pilot light will not be provided on the controller to indicate that power is available, as stipulated by NFPA 20. This deviation is acceptable because there are visual alarms for pump running, failure to start, and loss of power transmitted and annunciated in the main control room.

We, therefore, conclude that the above described controller design features are an acceptable deviation from Section C.6.b.(6) of BTP CMEB 9.5-1.

During our site audit, we observed that a required sectional control valve located at the discharge header of the fire pumps had not been installed. The absence of this valve would adversely affect fire protection during periodic testing of the pumps. By letter dated September 20, 1983, the applicant confirm that this valve was now in place. We consider this item resolved.

Water Suppression and Hose Standpipe Systems

During our site audit, we observed that the manual discharge valves for the water-deluge fire suppression systems protecting charcoal filters is located in close proximity to the filters. Because of this feature and the limited access in the area, we were concerned that if a fire occurred in the filters, the resulting high temperatures would prevent access to the valves. However, if a fire should occur, we expect the high temperature alarms to activate and annunciate in the control room, enabling the fire brigade to arrive before significant fire propagation and heat generation occurred. Also, by letter dated December 14, 1983, the applicant committed to develop a pre-fire strategy for these areas to alert the fire brigade as to the location of the valves. Operating personnel will utilize existing manual hose lines and discharge water to cool down the area and to shield the brigade members. These actions provide us with reasonable assurance that the valves for the suppression system can be reached and activated in the event of a fire in the filters. We, therefore, find this condition acceptable.

In the Fire Protection Report, the applicant committed to comply with NFPA Standard No. 13 in the design and installation of automatic sprinkler systems. During our site audit, we observed that the ceiling-level sprinklers over the lube oil drain tank were obstructed. By letter dated September 20, 1983, the applicant committed to provide additional sprinkler heads under the obstructions so as to provide complete sprinkler protection for the oil drain tank area. This work will be completed by fuel load. We find this acceptable.

During our site audit, we observed that the present location of hose stations would not permit a hose stream to reach all areas of the computer room, cable riser area and battery room on elevation 451 feet. We also observed that because of the congested conditions in certain plant areas, such as the cable spreading rooms, it would not be possible to utilize hose streams because of the inability to fully deploy the woven-jacketed fire hose. By letters dated September 20, 198 and July 6, 1984, the applicant committed to relocate an existing hose station to provide complete coverage for the above referenced areas. Also, in the September 20, 1983 letter, the applicant committed to replace existing woven-jacket fire hose in the upper and lower cable spreading rooms with a hard rubber-type hose. This work will be done by fuel load. We find this acceptable.

In the Fire Protection Report, the applicant committed to install the standpipe system in accordance with NFPA Stanard No. 14. Section 4-4.2 of this standard requires an approved pressure reducing device where standpipe outlet pressures exceed 100 pounds per square inch (psi). At Byron Station, outlet pressures exceed 100 psi. However, the fire brigade is trained in handling hose lines with nozzle pressures up to 200 psi. In addition, wherever outlet pressures exceeds 150 psi, a caution notice is posted. Because the brigade is trained with higher nozzle pressures; because high pressures on the water distribution system are necessary to support sprinkler system demand; and because the applican has located sensitive electrical components such that redundant shutdown systems will not be inadvertently damage by water from the hose streams; was conclude that the lack of pressure reducers is an acceptable deviation from Section C.6.c.(4) of BTP CMEB 9.5-1.

During our inspection, we observed that the installation of fire hose nozzles, hose houses and other manual fire fighting equipment was incomplete. By letter dated September 20, 1983, the applicant committed to complete the installation of this equipment by fuel load. This is in accordance with our guidelines and is, therefore, acceptable.

9.5.1.5 Fire Protection For Specific Plant Areas
Primary Containment

In the Fire Protection Report, the applicant requested approval for several deviations from the guidelines of Section C.5.6.(2) to the extent that it requires redundant shutdown divisions to be separated by 20 feet, free of intervening combustibles. Shutdown divisions not conforming to our separation criteria are physically separated within containment and outside of the pressurizer cubicles by a horizontal distance of 20 feet or more, with the presence of intervening combustible materials. The intervening combustible consist of a limited quantity of IEEE 383 qualified cable. The amount of combustible material within containment varies depending on the elevation. Existing fire protection includes ionization-type smoke detectors; manual hose stations; and portable fire extinguishers. Because the combustibles are widely dispersed and sources of ignition are limited, we do not expect a fire of significant magnitude or duration to occur. Smoke and hot gases from a postulated fire would be dissipated and cooled through the large open areas of containment. It is our judgment that, under these conditions, a fire would, at most, cause damage to systems from one shutdown division, but would not be able to propagate horizontally and damage the redundant division before self extinguishing or being suppressed by the plant fire brigade. Therefore, the presence of intervening combustible materials within containment is an acceptable deviation from Section C.5.6(2) of BTP CMEB 9.5-1.

For those systems, identified in the Fire Protection Report, which do not meet our separation criteria, a procedure exists which will enable operators to safely shutdown the plant in the event that a fire in containment causes the loss of redundant divisions. This conforms with the guidelines of Section C.5.c of BTP CMEB 9.5-1 and is, therefore, acceptable.

In our SER, the provision of an oil collection system for the reactor coolant pumps was an unresolved issue. In the Fire Protection Report and by letter dated August 20, 1984, the applicant committed to install an oil collection system capable of collecting lube oil from all potential pressurized and unpressurized leakage sites and to channel the oil from all four pumps to a vented and closed container. The system is designed and installed such that any failure will not lead to a fire during normal or design basis accident conditions, including the safe shutdown earthquake. This commitment satisfies the guidelines contained in Section C.7.a of BTP CMEB 9.5-1 and is, therefore, acceptable.

Control Room Complex

In the August 16, 1982 revision to the Fire Protection Report, the applicant comitted to comply with Section C.5.d of BTP CMEB 9.5-1 and with Section C.7.b, with the exception that an automatic fire suppression system will not be installed in "offices" in the control room complex. We observed that the computer related storage areas adjacent to the control room are not equipped with an automatic fire suppression system, which is not consistent with these commitments. By letter dated December 14, 1983, the applicant stated that the combustible loading in these rooms have been reduced. Fire Zone 2.1-1 (formerly a record storage room) is utilized as an office with a fire load of about 42,300 BTU/ft^2. The other area, Fire Zone 2.1-2 (formerly record storage and toilet room) is used to store paper for control room recorders and has a fire load of about 43,900 BTU/ft^2. Because of the reduced fire hazard and the existing fire protection, which includes automatic fire detection and manual fire fighting equipment, our original conclusion that an acceptable level of fire protection has been provided in these areas is still valid.

The August 16, 1982 revision to the Fire Protection Report identifies equipment located within the Control Room Refrigeration Equipment Rooms being necessary for safe shutdown. We were concerned that if a fire occurred

in these rooms, safe shutdown would not be able to be achieved and maintained. By letter dated September 20, 1983, the applicant provided the results of a reassessment of the systems in these rooms. On the basis of this reassessment, the applicant's Fire Protection Report was amended to indicate that this equipment was not necessary for safe shutdown. Because safe shutdown will not be affected by a fire in these rooms, we find that the existing level of fire safety is acceptable.

Automatic smoke dampers that close upon operation of a detection system are not provided in the control room vent ducts. Instead, two, 1-1/2-hr-rated fire dampers in series, outside smoke detectors, and motorized isolation dampers are provided. If a fire occurs adjacent to the control room, the installed early warning detection system would provide advance notice of the incipient fire conditions and fire fighting activities would serve to limit the size of the fire. In the event smoke enters the control room before the isolation dampers can be closed, the operators are provided with self-contained breathing apparatus. Because of this, we find this to be an acceptable deviation from our guidelines.

Fire detectors are not provided within all the control room cabinets. Detectors are provided in the main control console, in the vents of the cabinets and at the ceiling of the control room. This level of detection, along with the constant attendance in the control room, provides us with reasonable assurance that a fire, if one should occur, would be detected in its incipient stages. Therefore, the absence of detectors in each control room cabinet is an acceptable deviation from Section C.7.b of BTP CMEB 9.5-1.

Carpeting is installed on the floor of the control room. We were concerned that the carpet might represent a fire hazard, if ignited. However, the carpet has been tested in accordance with ASTM E-84. The results of the test demonstrate that the carpet has a flame spread rating of 25. On this basis, our guideline consider this material as noncombustible. We, therefore, find that the carpet in the control room is acceptable.

Cable Spreading Room

In our SER, the fire protection for the cable spreading rooms was not resolved. The applicant proposed to install an automatic halon fire suppression system and a manual carbon dioxide fire suppression system for the upper cable spreading room and an automatic carbon dioxide fire suppression system for the lower cable spreading room. This represents a deviation from our guidelines which calls for a water-type fire suppression system. We were concerned that this design would not be sufficiently reliable to provide us with reasonable assurance that a potential fire in these areas would be suppressed. However, by letter dated June 17, 1983, the applicant proposed measures which, in our opinion, would significantly enhance system reliability and effectiveness. Specifically, the applicant committed to electrically supervise all interior doors in the cable spreading rooms and to emphasize in the training of the fire brigade that the doors into these areas should remain closed. These measures along with the existing construction of the perimeter walls and floor/ceilings will provide us with reasonable assurance that extinguishing gas concentrations will be maintained. Also, additional detectors will be added to provide two separate detection circuits for the halon system and a second train of actuation logic will be added in parallel to the existing logic train. The existing Halon bottle discharge valve actuators will be replaced with a pair of pilot valves, each connected to one of the two trains of actuation logic, and either of which can actuate the Halon bottle discharge valve. An additional halon storage bottle has been provided to add redundance to the halon supply. Subsequently, we became concerned that the design of the CO_2 systems for the lower cable spreading room was not sufficiently redundant to preclude single failures from adversely affecting the automatic fire suppression capability. By letter dated September 19, 1984, the applicant committed to install redundant valves at the carbon dioxide storage tank and lower cable spreading room zone discharge valves. The installation of these valves will be complete prior to exceeding 5% power. These modifications will not be necessary prior to low power operation because only small quantities of radionuclide inventory will exist in the reactor coolant system and, therefore, will not affect the

health and safety of the public. The design and installation will be in accordance with NFPA 12. These valves are intended to be used to activate the CO_2 systems in the lower cable spreading room zones in the event of a failure of the normal tank or zone dischage valves. The Pre-Fire Plan strategies have been modified to include the use of this additional backup capability, if required. These measures mitigate our concern that a single failure could render the halon and CO_2 systems inoperable. We were also concerned that during periodic maintenance in the cable spreading rooms, the gaseous fire suppression systems would be deactivated and could not readily be reactivated in the event of a fire. However, the design of the systems is such that if it becomes necessary to discharge carbon dioxide into the cable spreading rooms because of a fire, this can be accomplished manually without need of any special tool or device. We, therefore, conclude that because of the above referenced modifications, the separation of redundant shutdown divisions into separate cable spreading rooms and the existing fire protection for these rooms as detailed in the Fire Protection Report, the lack of a water-type fire suppression system is an acceptable deviation from Section C.7.c of BTP CMEB 9.5-1.

In Amendment No. 3 to the Fire Protection Report, the applicant indicated that one of the "sub-areas" in the upper cable spreading room has only one access door. However, the other sub-areas have at least two doorways and access for fire brigade operations is unrestricted. Because of this and the availability of automatic fire suppression systems, we consider this condition acceptable.

Battery Rooms

During our inspection, we observed that the batteries were not separated from other areas of the plant by 3-hour fire rated barriers and "explosion-proof" lighting fixtures had not been installed in the battery room. We were concerned that the absence of a wall would adversely affect the ventilation system, resulting in an explosive mixture of hydrogen gas in air, which could be ignited by the non-explosion-proof electric fixtures. By letter dated

July 6, 1984, the applicant committed to install a 2-hour fire-rated wall between the batteries and the remaining electrical equipment in the battery room. This work will be done by fuel load. With this modification, the existing ventilation system will be able to limit hydrogen gas concentration so as not to exceed 2 percent. The safety-related battery rooms now comply with the guidelines in Section C.7.g. of BTP CMEB 9.5-1 and are, therefore, acceptable.

Diesel Generator Areas

In the August 16, 1982 revision to the Fire Protection Report, the applicant committed to comply with Section C.5.d(1), "Control of Combustibles" of BTP CMEB 9.5-1. In the diesel generator rooms and at the Auxiliary Fuel Pump Room, we observed that curbs were not provided at doorways into these areas and were concerned that a potential exist for a diesel fuel fire to propagate through the doorway into adjoining areas. However, by letter dated September 20, 1983, the applicant provided the results of a re-analysis of this potential problem in the above two areas. The applicant concluded that because of the existing floor drain capacity, embedded piping, curbing at the fuel oil day tank enclosure and control room alarm, the existing safeguards are sufficient to preclude a hazardous accumulation of fuel oil. We have reviewed this analysis and agree with the applicant that the above measures are sufficient to satisfy the guidelines contained in the above referenced section of BTP CMEB 9.5-1. This item is now considered resolved.

The cooling water lines for diesel generator 1A are routed through the room containing generator 1B. This represents a deviation from our guidelines because the 1A cooling water lines are not protected as stipulated in Section C.5.b.(2) of BTP CMEB 9.5-1. However, because of the complete, area wide, automatic fire detection and suppression systems; the steel pipe construction and the insulation for the cooling water pipes in the diesel generator rooms, a fire in Room 1B will not damage cooling water pipes for both diesel generators before being detected and extinguished. Therefore, the routing of cooling water lines for diesel generator 1A through the room containing diesel generator 1B is an acceptable deviation from the above referenced guidelines.

Other Areas

In Amendment No. 3 to the Fire Protection Report and by letter dated August 20, 1984, the applicant requested approval for several deviations from the guidelines of Section C.6.b(2) of BTP CMEB 9.5-1, which pertain to the protection of redundant shutdown-related systems. Specifically, the applicant requested approval: 1) where redundant divisions are separated by a continuous fire barrier which is not completely 3-hour fire rated; 2) where redundant divisions are located more than 40 feet apart, with some combustibles in the intervening space or separated by a 1-hour fire barrier and the area is not completely protected by an automatic fire suppression system; and 3) where a fixed fire suppression system is not installed in an area for which an alternate shutdown capability has been provided. These deviations are in addition to those previously reviewed in Sections 9.5.1.4 and 9.5.1.5 of this report.

In general, the plant locations where these deviations exist can be characterized by a low fire loading, with combustible material widely dispersed. If all of the combustibles were totally consumed, it would produce a fire of approximately 30 minute intensity as measured by the time-temperature curve of ASTM Standard E-119. However, such a worse-case event is not likely because of the available fire protection. In those locations where concentrated combustibles may be present, such as at the hatchways on elevation 364 feet of the Auxiliary Building, an automatic sprinkler system has been provided or one division of shutdown related cables have been protected by a 3-hour fire rated barrier. These areas also have large floor-to-ceiling heights and large room volumes which mean the effects of a fire, such as smoke and hot gases, will be dissipated. All of these locations have been provided with a complete smoke detection system which provides us with reasonable assurance that a potential fire will be detected in its early stages and suppressed manually by the fire brigade before significant propagation or damage occurs.

In several locations, such as on elevation 426 feet of the Auxiliary Building, masonry walls separate redundant shutdown divisions. The construction of these walls is such as to achieve at least a 3-hour fire rating. However, some unprotected penetrations exist in which would allow smoke and hot gases to propagate from one area to an adjoining location. In Amendment No. 3, the applicant committed to seal these openings with a noncombustible material such as silicone foam which will prevent fire propagation. This provides us with reasonable assurance that products of combustion will not spread beyond the fire area before the arrival of the plant fire brigade.

In some locations, such as on elevation 346 feet of the Auxiliary Building, redundant divisions are separated by more than 110 feet. Because of this large distance and the existing fire protection, we have reasonable assurance that if a fire should occur at least one shutdown division would remain free of damage.

In other locations, such as on elevation 364 feet of the Auxiliary Building, separation of redundant divisions is approximately 45 feet. However, the space between divisions is protected by automatic sprinklers. Redundant components are separated by masonry walls. And one division of redundant cables is protected by a 1-hour fire-rated barrier. We, therefore, conclude that no additional protection is required to assure that one division will be available to achieve and maintain safe shutdown.

For those fire areas, such as the control room and remote shutdown panel area, where a fixed fire suppression system has not been provided, if a fire of significant magnitude occurs and damages both shutdown divisions, an alternate shutdown method is available which is outside of these locations. No loss of shutdown capability occurs and, therefore, a fixed fire suppression system is not necessary to achieve an acceptable level of fire safety.

We, therefore, conclude that the devisions identified in Amendment No. 3 to the Fire Protection Report, and the applicant's August 20, 1984 letter, represent an acceptable level of safety to that achieved by literal compliance with Section C.6.b(2) of BTP CMEB 9.5-1.

During our site audit, we observed several discrepancies in the description of fire protection features in the applicant's Fire Protection Report from what was observed in the plant. Such discrepancies include the description of fire proofing for structural steel, the extent of fire detection in safety related plant areas, the nature of fire doors and the lack of a fire hazard's analysis and fire protection for the "Med-Chem" area on elevation 401 feet. By letter dated September 9, 1984 and in Amendment No 3 to the Fire Protection Report, the applicant corrected the discrepancies. We consider this issue resolved.

In Amendment No. 3, the applicant stated that for those areas which are not protected by a fixed fire suppression system, local fire alarms are not provided. However, the activation of the fire alarm and detection system will be annunciated audibly and visually in the control room. Upon receipt of an alarm, the control room operators have the capability as described in other sections of the SER, to summon and direct the fire brigade and to initiate local evacuation, if necessary. We conclude that this capability exceeds the guidelines contained in Section C.7 of BTP CMEB 9.5-1 and is, therefore, acceptable.

In Amendment No. 4 to the Fire Protection Report, the applicant provided the results of a complete reassessment of the plant fire protection program to the guidelines contained in the following NFPA standards:

NFPA 10, Portable Fire Extinguishers
NFPA 11, Foam Systems
NFPA 12, Carbon Dioxide Fire Extinguishing Systems
NFPA 12A, Halon 1301 Fire Extinguishing Systems
NFPA 13, Sprinkler Systems
NFPA 14, Standpipe and Hose Systems
NFPA 15, Water Spray Systems

NFPA 16, Foam Water Systems
NFPA 20, Fire Pumps
NFPA 24, Fire Mains and Hydrants
NFPA 26, Valve Supervision
NFPA 27, Private Fire Brigades
NFPA 30, Flammable Liquids Code
NFPA 37, Combustion Engines
NFPA 50A, Gaseous Hydrogen Systems
NFPA 72D, Proprietary Protective Signaling Systems
NFPA 72E, Fire Detectors
NFPA 80, Fire Doors
NFPA 90A, Air Conditioning and Ventilation Systems

The applicant has identified some deviations from the above guidance. The applicant has committed to modify certain fire protection features so as to be in conformance with the referenced standards.

Modifications in safety related areas are to be complete before the plant exceeds 5% power. Implementation of these modifications is not necessary prior to low power operation because only small quantities of radionuclide inventory will exist in the reactor coolant system and therefore will not affect the health and safety of the public. We, therefore, conclude that this represents an acceptable deviation from the guidelines in Section C.1.c(2) of BTP CMEB 9.5-1.

9.5.1.7 Conclusion

The technical requirements of Appendix R to 10 CFR 50 and Appendix A to ASB 9.5-1 have been included in BTP CMEB 9.5-1.

The following deviations from the guidelines of BTP CMEB 9.5-1 have been approved:

1. Protection of structural steel as described in Section 9.5.1.4.

2. Continuity of floor/ceiling assemblies as described in Section 9.5.1.4.

3. Acceptance criteria for fire barrier penetrations as described in Section 9.5.1.4.

4. Unlisted fire doors as described in Section 9.5.1.4.

5. Design of the fire pumps controller as described in Section 9.5.1.4.

6. Seismic design of the standpipe system as described in Section 9.5.1.5 of the SER.

7. Absence of pressure reducers for the standpipe system is described in Section 9.5.1.5.

8. Fire Protection for Containment as described in Section 9.5.1.5.

9. Fire Protection for the Control Room Complex as described in Section 9.5.1.5.

10. Fixed fire suppression systems in the Cable Spreading Rooms as described in Section 9.5.1.5.

11. The separation of cooling water lines for the diesel generators in Room 1B as described in Section 9.5.1.5.

12. Deviations from BTP CMEB 9.5-1 in other plant areas as described in Section 9.5.1.5.

13. Implementation of fire protection modifications as described in Section 9.5.1.5.

Byron Fire Protection License Condition

Fire Protection (Section 9.5.1, SSER 5)

a. The licensee shall maintain in effect all provisions of the approved fire protection program as described in the Fire Protection Report for the facility through Amendment 4 and as approved in the SER through Supplement 5, subject to provisions b & c below.

b. The licensee may make no change to the approved fire protection program which would decrease the level of fire protection in the plant without prior approval of the Commission. To make such a change the licensee must submit an application for license amendment pursuant to 10 CFR 50.90.

c. The licensee may make changes to features of the approved fire protection program which do not decrease the level of fire protection without prior Commission approval after such features have been installed, provided such changes do not otherwise involve a change in a license condition or technical specification or result in an unreviewed safety question (see 10 CFR 50.59). However, the licensee shall maintain, in an auditable form, a current record of all such changes including an analysis of the effects of the change on the fire protection program and shall make such records available to NRC inspectors upon request. All changes to the approved program made without prior Commission approval shall be reported to the Director of the Office of Nuclear Reactor Regulation, together with supportive analyses within 60 days of the change.

d. Prior to exceeding 5% power, Commonwealth Edison Company shall complete all modifications related to National Fire Protection Association Code conformance as delineated in Amendment 4 to the Fire Protection Report.

e. Prior to exceeding 5% power, Commonwealth Edison Company shall complete the modifications to the carbon dioxide fire suppression system as described in their letter of September 19, 1984.

Input to the SALP Process

A. Functional Area: Fire Protection

1. Management involvement in assuring quality: Throughout the last year of the review process, the applicant's activities exhibited evidence of prior planning and assignment of priorities. Decisions which were made were usually at a level that ensured adequate management review. Management was aware of the importance of fire protection and tonk steps to see that our review and site audit went well including making contractor representatives available as needed.

Rating Category 2

2. Approach to resolution of technical issues: During the various meetings, telecons, an in the several documents submitted in conjunction with the resolution of our site audit issues, the applicant's representatives displayed a clear understanding of our concerns with the level of fire protection. The applicant's additional fire protection commitments during the last year revealed a conservative approach toward providing an adequate level of safety. The justification provided in support of the applicant's fire protection program was based on sound fire protection engineering principles. With the exception of the documentation of deviations from Section III.G of Appendix R and NFPA Standards and the design of the RCP oil collection system, where additional analyses was necessary, all outstanding issues were resolved in a timely manner.

Rating Category 1

3. Responsiveness to NRC Initiatives: With one exception (protection of structural steel), the applicant provided timely written and oral responses to our requests for information. Although, most of the proposals offered to resolve our fire protection concerns could be construed as viable, our effort to resolve some issues required a number of submittals before acceptable resolution was achieved.

Rating Category 2