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June 10, 1983

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket Nos. 50-352
50-353

Subject: Limerick Generating Station, Units 1 & 2
Draft Fire Protection Section of the
Safety Evaluation Report

Reference: Letter, A. Schwencer to E. G. Bauer, Jr.,
dated April 19, 1983

Dear Mr. Schwencer:

Transmitted herewith are draft responses to open items no. 2, 7, 9, 11, 12, 16, 18, 19, 21, 27, and 34 which were transmitted by the reference letter. This material is provided in draft form at the request of Mr. Eberly, NRC staff reviewer. FPER page changes will be submitted in August, 1983.

Sincerely,

Eugene J. Bradley

JJH/gra/20

Copy to: See Attached Service List

B002
1/1

cc: Judge Lawrence Brenner (w/o enclosure)
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NRC Open Item #2: Fire Hazards Analysis

Redundant trains of components that are susceptible to damage from water spray are physically separated so that manual fire suppression activities will not adversely affect the operability of components not involved in the postulated fire. However, we cannot determine if mechanisms by which fire and fire fighting systems may cause the simultaneous failure of redundant or diverse trains have been considered in the design. We require that the applicant identify such mechanisms that were considered in its fire hazards analysis and the measures taken to preclude the fire or fire suppressant induced failure of redundant or diverse safety trains.

CMEB Position

Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components. [Except from General Design Criterion 3, Appendix A to 10 CFR Part 50].

LGS Response

The Limerick design with respect to the potential for rupture or inadvertent operation of fire suppression systems is addressed in FPER Section 3.1, Item 24. As noted in Item 24, moderate-energy leakage cracks in fire suppression system piping were analyzed as discussed in FSAR Section 3.6. FSAR Section 3.6.1.2.2 summarizes the results of the moderate-energy fluid system analysis and also provides references to other FSAR sections that discuss the design bases and criteria that were used in the moderate-energy fluid system analysis. The analysis demonstrates that the occurrence of a crack in moderate-energy piping, including the fire suppression system piping, will not prevent the plant from being brought to a safe, cold shutdown.

Automatic suppression systems have been designed and located so that operation of the systems, either intentional or inadvertent, will not cause damage to redundant trains of safety-related equipment that is needed for safe shutdown of the plant. To the greatest extent practical, safety-related electrical components are located outside the coverage zones of automatic suppression systems. Where necessary, components that are needed in order to achieve safe shutdown and also are located within automatic suppression system coverage zones are designed to remain functional in the event of suppression

system actuation. Three of the areas that are provided with automatic water-type suppression systems are the HPCI pump compartment, the RCIC pump compartment, and the diesel-generator cells. Actuation of the suppression systems in the HPCI and RCIC pump compartments could cause damage significant enough to affect the operability of the systems in those compartments. In the diesel-generator cells, baffles are provided to protect the generators and control devices from damage due to suppression system actuation, but each diesel-generator will be automatically tripped if the suppression sysem in its cell is actuated. Loss of any of these three systems (HPCI, RCIC, or a single diesel-generator) due to suppression system actuation is acceptable, since redundant systems will remain available to bring the plant to a safe, cold shutdown.

INDIVIDUAL
The diesel-generators are the only safe shutdown components that have an electrical interconnection with fire detection or fire suppression systems. Therefore, safe shutdown components other than the diesel-generators cannot be inadvertently actuated or shut down due to either normal or abnormal signals in the control and power circuits of the fire detection and fire suppression systems.

INDIVIDUAL

The HPCI and RCIC pump compartments and the diesel-generator cells are the only safety-related areas of the plant that are provided with automatic suppression systems and also are potentially subject to steam flooding as a result of high-energy pipe breaks. Elevated compartment temperatures due to steam flooding could result in suppression system actuation if the temperatures are high enough to cause the deluge valve to open and the fusible links on the sealed sprinkler heads to open. However, loss of the HPCI systems, RCIC system, or single diesel-generator due to suppression system actuation is acceptable, since redundant systems will remain available to bring the plant to a safe, cold shutdown.

Automatic (water) suppression systems located in safety-related areas of the plant are of the type that have fusible heads (either pre-action or wet pipe). These systems cannot be actuated in the absence of a significant heat source in the vicinity of the sprinkler heads. Therefore, electrical anomalies in the circuits of the smoke and heat detection systems or the suppression system power supplies cannot cause inadvertent actuation of these suppression systems.

The consequences of fire fighting water discharge into nonsafety-related areas of the plant are discussed in the response to Open Item #9.

Section 5.1 of the FPER describes the methodology that was used in evaluating the effects of postulated fires on the capability to achieve safe shutdown of the plant. The assumptions and design bases involved in this evaluation are identified in Section 5.1. Section 5.2.2 of the FPER provides a description of the four methods of achieving safe shutdown that were analyzed, including identification of the individual components that are utilized in each of

the shutdown methods. Consideration of the need to manually position certain motor-operated valves is included in Section 5.2.2.

Postulated fires are considered to be capable of rendering a component inoperable either by directly damaging the component or by damaging electrical cabling that serves the component to the extent that circuit faults occur. Possible failure modes of circuits that are damaged by fire are considered to include open circuits, hot shorts, and shorts to ground. Components and/or cables that are associated with redundant shutdown methods and are horizontally separated from each other by less than 20 feet within the same fire area are considered to be damaged simultaneously by a postulated fire, unless one of the redundant trains of components/cables is enclosed by a fire barrier having a minimum rating of 1 hour. The measures that have been taken to preclude a postulated fire from causing concurrent damage to all four of the specified shutdown methods are discussed for each individual fire area in Sections 5.3 through 5.9 of the FPER.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section A.2 and D.1(b)

2. Branch Technical Position CMEB 9.5-1, Section C.1.b.

NRC Open Item #7: Fire Doors

The doors between the turbine building and areas of the plant containing safe shutdown systems are not labeled fire doors. Although these steamtight doors are certified by the manufacturer to be constructed in the same manner as the labeled doors, their method of installation as a steamtight door generally precludes the necessary gaps for expansion and distortion for a labeled fire door assembly and would probably not provide the necessary fire resistance.

CMEB Position

We will require that either labeled 3 hr. fire door assemblies be provided at all such openings or replicate assemblies of the steamtight doors be tested by a nationally recognized testing laboratory to show that they provide equivalent fire protection when subjected to the ASTM E-119 time temperature curve for 3 hours.

LGS Response

There are fifty-two steamtight doors at Limerick. All single-leaf steamtight doors that are located in 3-hour fire walls are rated as Class A UL-labeled doors. Seven of the fifty-two are double steamtight doors in the walls between the control structure and the turbine enclosure are designated as fire rated but are not provided with UL labels. These double doors are similar to the UL-labeled doors with the exception of the following design differences from UL tested and approved assemblies:

a. Door size - the size tested by UL is 6'-0" by 7'-2" whereas the maximum size of the Limerick doors is 10'-0"x11'-0".

b. Door thickness - the maximum thickness tested by UL is 2-3/4" whereas the maximum thickness of the Limerick doors is 9".

c. Limerick doors contain a removable mullion that is not present in the UL tested assemblies.

d. Minor hardware differences as follows:

   1. Customized hinges
   2. Locksets by Sonicbar Door Systems
   3. Additional security hardware

e. Limerick doors are equipped with elastomeric gaskets to assure steam tightness.

f. NFPA-80, Chapter 2, Section 5.4 specifies that the maximum gap between door and frame is 1/8 inch and between door and sill is 3/8 inch. All double leaf doors meet the above criteria.

The fire loadings on either side of the subject doors ~~is~~ are low. The maximum equivalent severity in adjacent compartment is 32 minutes. In none of the cases are the in-site combustibles located immediately adjacent to the doors. The table below provides the door number, elevation, fire areas and equivalent severity and steam pressure the doors must withstand.

These double steamtight doors are certified by the manufacturer to be constructed as closely as possible to the Underwriters Laboratories procedure for 3-hour rated, Class A, special purpose door units (file No. R7643, Vol. 1).

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section D.1(j)
2. Branch Technical Position CMEB 9.5-1, Section C.5.a(5)

Door No.	Elev.	Adjacent Fire Area	Equivalent Severity (mins)	Adjacent Fire Area	Equivalent Severity (Mihs)	Steam Pressure (psig
146	200'-0"	89A	32	IL	3	4
150	200'-0"	102A	32	IN	-	4
151	200'-0"	102A	32	IM	3	4
204	217'-0"	04A	13	2	10	.75
205	217'-0"	113A	10	2	10	4
288	217'-0"	107A	13	2	10	.75
543	304'-0"	99A	2	27	14	.5

Note: Fire areas 89A and 102A are provided with automatic water suppression over the Reactor Feed Pump Lube Oil reserviors.

NRC Open Item #9: Floor Drains

Some areas of the plant are not equipped with floor drains. The applicant states that collected fire fighting water could be drained through the doorways to the adjacent rooms. This is not consistent with our guidelines in Section C.5.a(14) of BTP CMEB 9.5-1. It is our concern that redundant trains of safety-related equipment in unaffected areas could be flooded by excess fire fighting water.

CMEB Position

We require that the applicant provide suitable floor drains or a system of drains and curbs to prevent flooding of safety related equipment.

LGS Response

The only fire areas that are not provided with floor drains and which contain safety-related equipment that is needed for safe shutdown are the 4-kV switchgear compartments (fire areas 12 through 19) and the static inverter compartments (fire areas 20 and 21). The use of hand-held fire hoses in any of these fire areas will not result in flooding that causes unacceptable damage to safety-related equipment.

A fire hose can be used in the 4-kV switchgear compartments only by bringing the hose in through a doorway from adjacent fire areas. For fire areas 12, 14, 16, and 18, the fire hose would be brought in from the generator equipment area (fire zone 113B) along the north side of the control structure. Water discharged from a hose in one of these 4-kV switchgear compartments would flow through the open doorway to fire zone 113B and drain into the floor drains in that area. For fire areas 13, 15, 17, and 19, the fire hose would be brought in from the equipment hatch corridor (fire areas 97 for Unit 1 and 110 for Unit 2) via the control structure corridor (fire area 7). Water discharged from a hose in one of these 4-kV switchgear compartments would flow through the open doorway to fire area 7 and then through the doorway to the equipment hatch corridor. The equipment hatch corridor is provided with floor drains to dispose of the fire fighting water. Since the control structure corridor does not contain any safe shutdown components, the drainage of fire fighting water through the corridor will not have an adverse effect on safe shutdown capability. For either case of the two water discharge paths described above, water discharge from a fire hose in one of the 4-kV switchgear compartments has been determined to result in a maximum water level lower than the water level that would cause damage to the safe shutdown components in the compartment. Therefore, additional floor drains are not needed to ensure that safe shutdown capability is retained.

A fire hose can be used in the Unit 1 static inverter compartment (fire area 20) only by bringing the hose in from the Unit 1 cable spreading room through an open doorway. Although the Unit 2 static inverter compartment (fire area 21) contains a manual hose station, the fire brigade would fight a fire in this compartment using a hose brought in from the generator equipment area (fire zone 113B) through an open doorway. For both the Unit 1 and Unit 2 static inverter compartments, the doorway that is used for access will remain open during fire fighting activities within the compartment. Water discharged from a hose in the Unit 1 static inverter compartment would flow through the open doorway to the Unit 1 cable speading room, whereas water discharged from a hose in the Unit 2 static inverter compartment would flow to the generator equipment area. The cable spreading rooms and the generator equipment area are each provided with floor drains to dispose of the fire fighting water. Since the cable spreading room does not contain any safe shutdown components, the drainage of fire fighting water into the spreading room from the static inverter compartment will not have an adverse effect on safe shutdown capability. For either of the water flow paths described above, water discharge from a fire hose in one of the static inverter compartments has been determined to result in a maximum water level lower than the water level that would cause damage to the safe shutdown components in the compartment. Furthermore, loss of the safe shutdown components in a static inverter compartment would not prevent safe shutdown from being achieved, since the redundant safe shutdown components would remain operable. Therefore, additional floor drains are not needed to ensure that safe shutdown capability is retained.

The provisions discussed above for drainage of fire fighting water out of the 4-kV switchgear compartments and the static inverter compartments are in full compliance with Section C.5.a(14) of BTP CMEB 9.5-1.

Nonsafety-related areas of the plant that adjoin safety-related areas are provided with floor drains. As a result, fire fighting water that is discharged into the nonsafety-related areas will be disposed of through the floor drains, so that water will not accumulate on the floor and create a potential for inadvertent flooding of the adjoining safety-related areas. The reactor enclosure and control structure are the only safety-related structures that are constructed with their walls adjoining nonsafety-related structures. It has been verified that those areas in the tubine enclosure and radwaste enclosure that are in the vicinity of doorways leading into the reactor enclosure and control structure are provided with floor drains.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section D.1(i)

2. Branch Technical Position CMEB 9.5-1, Section C.5.a(14)

NRC OPEN ITEM #11: SAFE SHUTDOWN CAPABILITY

We have reviewed the means of separation proposed to ensure that one train of cables and equipment needed to safely shut down the plant will be maintained free of fire damage. In the following areas, the applicant has not met our guidelines in Section C.5.b of BTP CMEB 9.5-1.

(a) Fire Area 2, 13 kv switchgear area
Deficiency: Separation not specified
30 minute barrier in lieu of 1 hour
No automatic suppression

(b) Fire Area 7, Corridor elev. 239'
Deficiency: Separation not specified
30 minute barrier in lieu of 1 hour
No automatic suppression

(c) Fire Area 12 Unit 1, 4kv Switchgear Area
Deficiency: No automatic suppression

(d) Fire Area 20, Unit 1, Static Inverter Compartment
Deficiency: No automatic suppression

(e) Fire Area 25, Aux. Equipment Room
Deficiency: Separation Not Specified
No barriers provided
No automatic suppression above floor

(f) Fire Area 27, Control Structure Fan Room
Deficiency: 30 minute barrier in lieu of 1 hour
No automatic suppression

(g) Fire Area 40, Corridor elev. 177'
Deficiency: No automatic suppression

(h) Fire Area 43, Safeguard System Isolation Valve Area
Deficiency: No automatic suppression

(i) Fire Area 44, Safeguard System Access Area
Deficiency: Separation Not Specified
30 minute barriers in lieu of 1 hour
No automatic suppression

(j) Fire Area 45, CRD Hydraulic Equipment Area and Neutron Monitoring System Area
Deficiency: Separation Not Specified
30 minute barriers in lieu of 1 hour
No automatic suppression

(k) Fire Area 47, RWCU Compartments, FPCC Compartment & General Equipment Area
Deficiency: 30 minute barriers in lieu of 1 hour
No automatic suppression throughout the area

Fire Area 48, RWCU Holding Pump Compartments, RERS Fan Area and Corridors
Deficiency: No automatic suppression

The applicant has not justified these deviations from BTP CMEB 9.5-1 Section C.5.b.

CMEB Position

(1) Fire protection features should be provided for structures, systems, and components important to safe shutdown. These features should be capable of limiting fire damage so that:

(a) One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and

(b) Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

(2) To meet the guidelines of Position C5.b.1, one of the following means of ensuring that one of the redundant trains is free of fire damage should be provided.

(a) Separation of cables and equipment and associated circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers should be protected to provide fire resistance equivalent to that required of the barrier;

(b) Separation of cables and equipment and associated circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system should be installed in the fire area; or

(c) Enclosure of cable and equipment and associated circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system should be installed in the fire area.

(3) If the guidelines of Positions C5.b.1 and C5.b.2 cannot be met, then alternative or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area, room, or zone under consideration should be provided.

LGS Response

Revision 3 of the LGS Fire Protection Evaluation Report includes an updated summary of the analyses that have been performed to verify that safe shutdown capability is retained in the event of a postulated fire occurring within the plant. The safe shutdown analyses for the control structure and reactor enclosure are contained in FPER Sections 5.3 and 5.4, respectively.

The use of 30-minute fire barriers on electrical raceways, as described in previous revisions of the FPER, is no longer planned. All fire barriers installed on raceways for the purpose of ensuring safe shutdown capability will have ratings of either 1 hour or 3 hours. The individual cases where these fire barriers will be used are discussed in FPER Sections 5.3 and 5.4.

For fire areas 2, 7, 12 and 20, the raceways within each area that contain cables associated with one selected shutdown method will be enclosed by 3-hour rated fire barriers. This fire protection ensures that the selected shutdown method will remain operable in the event of a fire occurring in any of the applicable fire areas. This design is in full compliance with the guidelines of Section C.5.b of BTP CMEB 9.5-1.

Discussion of safe shutdown capability for fires occurring in fire area 25 is presented in the responses to Open Items #12 and #31.

Fire area 27 is now provided with a pre-action sprinkler system, as described in Revision 3 of the FPER. This system provides automatic fire suppression coverage for all of the floor area within the room except the perimeter areas on the west and south sides of the room. Components within fire area 27 that are needed for operation of redundant trains of safe shutdown systems are separated by more than 20 feet horizontally. Raceways associated with one of the safe shutdown methods will be enclosed by a fire barrier with a minimum 1-hour rating in areas where the raceways of the selected shutdown method are separated from components or raceways associated with redundant shutdown methods by less than 20 feet horizontally. These provisions ensure that safe shutdown capability will be retained in the event of a fire in fire area 27.

Fire area 40 does not contain any components or cabling associated with shutdown method D, which ensures that shutdown method D will remain operable in the event of a fire in this area. This design is in compliance with the guidelines of Section C.5.b of BTP CMEB 9.5-1.

The only components in fire area 43 that are associated with shutdown methods C and D are a pair of redundant primary containment instrument gas (PCIG) valves. The horizontal separation between the two valves is greater than 140 feet, and the only combustible materials in the intervening space are electrical cables in cable tray. A 20 foot wide zone that is free of combustibles will be created by using 1-hour rated fire barriers to enclose the cable trays that pass through the zone. Since the two PCIG valves are located on opposite sides of the primary containment, the 140-foot separation distance is measured around the circumference of the primary containment. The minimum horizontal separation between raceways associated with shutdown method C and those associated with shutdown method D is greater than 40 feet. To provide additional protection against the effects of fires, the raceways within fire area 43 that are associated with shutdown method D and are separated from components or raceways associated with shutdown method C by less than 85 feet (measured around the circumference of the primary containment) will be enclosed by 3-hour rated fire barriers. This fire protection ensures that either shutdown method C or shutdown method D will remain available to shut the plant down in the event of a fire occurring in fire area 43.

Revision 3 of the FPER discusses two RHR system valves (HV-51-182A&B) that are located in fire area 43, and indicates that these valves are needed for safe shutdown. Provisions will be made so that neither of these valves is associated with any of the four shutdown methods. Circuit breakers in the motor control centers that provide power to the RHR valves will be locked open so that fire-caused damage to the cables associated with the valves will not cause the valves to open inadvertently. No movement of these two RHR valves is necessary for achieving cold shutdown.

Fire area 44 contains components associated with shutdown methods A, B, C, and D. Shutdown methods C and D involve the fewest components located within the fire area. The horizontal separation between components associated with shutdown method C and those associated with shutdown method D is greater than 60 feet, and the only combustible materials in the intervening space are electrical cables in cable tray. A 20 foot wide zone that is free of combustibles will be created at two locations in fire area 44 by using 1-hour rated fire barriers to enclose the cable trays that pass through the zone. A fixed suppression system of the water curtain type will be installed within each combustible-free zone to provide assurance that a postulated fire due to transient combustibles can be prevented from propagating through the combustible-free zone. The water curtain systems are described at the end of this response. The two combustible-free zones, one located in the southwest quadrant of the fire area and one located in the northeast quadrant of

the fire area, divide fire area 44 into a western portion and an eastern portion. The western portion does not contain any components or raceways associated with shutdown method D. The eastern portion contains no components associated with shutdown method C, but does contain a number of raceways associated with shutdown method C. These latter raceways will be enclosed by 3-hour rated fire barriers. The provisions described above ensure that the plant can be safely shutdown using shutdown method D in the event of a fire in the western portion of fire area 44 and using shutdown method C in the event of a fire in the eastern portion of fire area 44.

Fire area 45 contains components associated with shutdown methods A, B, C, and D. Shutdown methods A and B have been selected for use in the event of a fire in this fire area. The horizontal separation between components associated with shutdown method A and those associated with shutdown method B is greater than 90 feet, and the only combustible materials in the intervening space are electrical cables in cable tray. A 20 foot wide zone that is free of combustibles will be created by using 1-hour rated fire barriers to enclose the cable trays that pass through the zone. A fixed suppression system of the water curtain type will be installed within the combustible-free zone to provide assurance that a postulated fire due to transient combustibles can be prevented from propagating through the combustible-free zone. The water curtain system is described at the end of this response. The combustible-free zone divides the fire area into a western portion and an eastern portion. The western portion does not contain any components associated with shutdown method B, and the eastern portion does not contain any components associated with shutdown method A. However, certain raceways associated with shutdown method B are routed through the western portion, and certain raceways associated with shutdown method A are routed through the eastern portion. All of these raceways will be enclosed by 3-hour rated fire barriers. The provisions described above ensure that the plant can be safely shutdown using shutdown method B in the event of a fire in the western portion of fire area 45 and using shutdown method A in the event of a fire in the eastern portion of fire area 45.

Fire area 47 contains components associated with shutdown methods A, B, C and D. Shutdown methods A and B have been selected for use in the event of a fire in this fire area. The southwest quadrant of fire area 47 does not contain any components or raceways that are associated with shutdown methods A or B. This quadrant, together with a 3-hour fire wall on the north side of fire area 47, divides the fire area into a western portion and

an eastern portion. The western portion does not contain any components or raceways associated with shutdown method B. The eastern portion contains no components associated with shutdown method A, but does contain a number of raceways associated with shutdown method A. These latter raceways will be enclosed by 3-hour rated fire barriers.

The southwest quadrant of fire area 47 provides adequate separation between the western and eastern portions of the fire area because of the substantial distance that exists between the components and raceways associated with shutdown method A and those associated with shutdown method B. The horizontal separation between components associated with shutdown method A and those associated with shutdown method B is greater than 100 feet, with no intervening combustibles other than cables in cable tray. There are no cable trays that provide a continuous pathway between the western and eastern portions of the fire area, and a 20 foot wide zone that is free of combustibles will be maintained within the southwest quadrant. The horizontal separation between raceways in the western portion that are associated with shutdown method A and raceways in the eastern portion that are associated with shutdown method B is greater than 80 feet.

The provisions described above ensure that the plant can be safely shutdown using shutdown method B in the event of a fire in the western portion of fire area 47 and using shutdown method A in the event of a fire in the eastern portion of fire area 47.

The only components in fire area 48 that are needed for safe shutdown are two load centers and their associated transformers. Load center 10B201 is needed for shutdown methods A and C, whereas load center 10B202 is needed for shutdown methods B and D. The horizontal separation between the two load centers is greater than 35 feet, and the only combustible materials in the intervening space are electrical cables in cable tray. A 20 foot wide zone that is free of combustibles will be created by using a 1-hour rated fire barrier to enclose the cable tray that passes through the area between the two load centers. A fixed suppression system of the water curtain type will be installed within the combustible-free zone to provide assurance that a postulated fire due to transient combustibles can be prevented from propagating through the combustible-free zone. The water curtain system is described at the end of this response. All raceways that are associated with shutdown methods A or B and are routed through the area between the two load centers will be enclosed by 3-hour rated fire barriers. The provisions described above ensure that the plant can be safely shutdown in the event of a fire in fire area 48, using shutdown method B for fires west of the water curtain and shutdown method A for fires east of the water curtain.

As stated in the discussions of individual fire areas, water curtain suppression systems will be installed in fire areas 44, 45, and 48. Each of the water curtains will be designed to achieve a discharge density of 0.3 gpm/ft^2 at floor level. This will be accomplished through the use of open head, solid cone, directional water spray nozzles arranged in a linear array across the top of the water curtain location, plus spray nozzles discharging horizontally inward from the sides of the water curtain where needed to achieve the design discharge density. Each water curtain system will be actuated manually from a local pull station. Actuation of a water curtain system will initiate an alarm throughout the plant. An OS&Y gate valve located upstream of the deluge valve in each system will be used to terminate operation of the system after it has been actuated. The OS&Y gate valve will be provided with a tamper switch for supervision. The electrical supervision signal is indicated at fire protection alarm panel OOC926, located near the entrance to the control room, and is annunciated inside the control room.

The local pull station for each water curtain system will be located IN a nearby stairwell. ~~mounted either inside the stairwell or on the wall immediately outside the stairwell entrance. (The pull station will be located outside the stairwell only if the water curtain system that it control is more than 70 feet away from the stairwell.)~~ These pull station locations will provide easy access for the fire brigade to manually actuate the water curtain systems. To reach any of these pull stations in the reactor enclosure, personnel in the control room (located at elevation 269 feet) would exit the control room into the turbine enclosure, enter the reactor enclosure through a doorway at elevation 269 feet, and walk up or down in stairwell No. 4 (at the northwest corner of the Unit 1 reactor enclosure) until reaching the elevation at which a fire has occurred. The maximum distances that personnel would have to walk up or down in the stairwell would be 44 feet up (to elevation 313 feet) and 52 feet down (to elevation 217 feet). The corridors through which personnel would travel from stairwell No. 4 to each of the pull stations (if located at a stairwell other than stairwell No. 4) are uncongested and therefore provide a path for rapid access to the pull stations. Fire detectors are located ON ~~near~~ each SIDE of the water curtain systems and will provide early warning of incipient fires near the water curtains. This combination of early warning from the fire detection system and easy access to the pull stations ensures that the fire brigade will be able to actuate a water curtain system well within the time period in which it is needed to prevent the spread of a postulated fire.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section A.2

2. Branch Technical Position CMEB 9.5-1, Section C.5.b

NRC Open Item: #12 Alternate Shutdown

"We have evaluated the fire protection provided for the remote shutdown panel and conclude that it is not physically separated from the control room in accordance with our guidelines in Section C.5.c of BTP CMEB 9.5-1. The remote shutdown panel is located in the Auxiliary Equipment Room (Fire Area 25) along with PGCC cabinets and therefore, this area contains systems for both the normal shutdown system and the alternative shutdown capability for both units. The applicant has orally indicated that additional information will be submitted on this item."

CMEB Position

C.5.c. Alternative or Dedicated Shutdown Capability

(1) Alternative or dedicated shutdown capability provided for a specific fire area should be able to achieve and maintain subcritical reactivity conditions in the reactor, maintain reactor coolant inventory, achieve and maintain hot standby conditions for a PWR (hot shutdown for a BWR) and achieve cold shutdown conditions within 72 hours and maintain cold shutdown conditions thereafter. During the postfire shutdown, the reactor coolant system process variables shall be maintained with those predicted for a loss of normal ac power, and the fission product boundary integrity shall not be affected; i.e., there shall be no fuel clad damage, rupture, or any primary coolant boundary, or rupture of the containment boundary.

(2) The performance goals for the shutdown functions should be:

(a) The reactivity control function should be capable of achieving and maintain cold shutdown reactivity conditions.

(b) The reactor coolant makeup function should be capable of maintaining the reactor coolant level above the top of the core for BWRs and be within the level indication in the pressurizer for PWRs.

(c) The reactor heat removal function should be capable of achieving and maintaining decay heat removal.

(d) The process monitoring function should be capable of providing direct readings of the process variables necessary to perform and control the above functions.

(e) The supporting functions should be capable of providing the process cooling, lubrication, etc., necessary to permit the operations of the equipment used for safe shutdown functions.

(3) The shutdown capability for specific fire areas may be unique for each such area, or it may be one unique combination of systems for all such areas. In either case, the alternative shutdown capability shall be independent of the specific fire area(s) and shall accomodate postfire conditions where offsite power is available and where offsite power is not available for 72 hours. Procedures shall be in the effect to implement this capability.

(4) If the capability to achieve and maintain cold shutdown will not be available because of fire damage, the equipment and systems comprising the means to achieve and maintain the hot standby or hot shutdown condition shall be capable of maintaining such conditions until cold shutdown can be achieved. If such equipment and systems will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. The number of operating shift personnel, exclusive of fire brigade members, required to operate such equipment and systems shall be onsite at all times.

(5) Equipment and systems comprising the means to achieve and maintain cold shutdown conditions should not be damaged by fire; or the fire damage to such equipment and systems should be limited so that the systems can be made operable and cold shutdown achieved within 72 shours. Materials for such repairs shall be readily available onsite and procedures shall be in effect to implement such repairs. If such

equipment and systems used prior to 72 hours after the fire will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system should be provided. Equipment and systems used after 72 hours may be powered by offsite power only.

(6) Shutdown systems installed to ensure postfire shutdown capability need not be designed to meet seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where required for other reasons, e.q., because of interface with or impact on existing safety systems, or because of adverse valve actions due to fire damage.

(7) The safe shutdown equipment and systems for each fire area should be known to be isolated from associated circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. The separation and barriers between trays and conduits containing associated circuits of one safe shutdown division and trays and conduits containing associated circuits or safe shutdown cables from the redundant division, or the isolation of these associated circuits from the safe shutdown equipment, should be such that a postulated fire involving associated circuits will not prevent safe shutdown.

LGS Response:

The Remote Shutdown Panels (10C201 and 20C201) will be enclosed by walls which separate these panels from the rest of the Auxiliary Equipment Room. These walls will have a three hour fire rating. All cabling going to the Remote Shutdown Panels which pass through the Auxiliary Equipment Room will be encapsulated by a three hour fire barrier. Access to the new remote shutdown room will be provided so that operating personnel will not be required to pass through the Auxiliary Equipment Room to gain access to the Remote Shutdown Panels. These measures will assure that the units can be brought to a safe cold shutdown condition during a fire in the Auxiliary Equipment Room.

The addition of the walls around the Remote Panels creates a new fire area (Area 26, Remote Shutdown Room). For a fire within this room, safe shutdown can be achieved from the Control Room using either shutdown methods B or D.

The above provisions assure that alternate shutdown capability exists for fires in the Control Room, Auxiliary Equipment Room, Remote Shutdown Room and Cable Spreading Room. The requirements of the above cited section of BTP CMEB 9.5-1 are therefore satisfied.

Limerick will comply with the requirements of BTP CMEB 9.5-1, Section C.5.c, in Fire Area 25 and 26.

References: None

Drawings: FPER Figure B-21 ~~(attached)~~

NRC Open Item: #16 Emergency Lighting

"This does not meet our guidelines in Section C.5.g of BTP CMEB 9.5-1 because upon loss of offsite power only one hour of emergency lighting capability is provided. We require the applicant to provide 8-hour self-contained battery powered lighting units in all areas needed for operation of safe shutdown equipment and in access and egress routs thereto."

CMEB Position

C.5.g. Lighting and Communication

Lighting and two-way voice communication are vital to safe shutdown and emergency response in the event of fire. Suitable fixed and portable emergency lighting and communication devices should be provided as follows:

(1) Fixed self-contained lighting consisting of flourescent or sealed-beam units with individual 8-hour minimum battery power supplies should be provided in areas that must be manned for safe shutdown and for access and agrees routes to and from all fire areas. Safe shutdown areas include those required to be manned if the control room must be evacuated.

(2) Suitable sealed-beam battery-powered portable hand lights should be provided for emergency use by the fire brigade and other operations personnel required to achieve safe plant shutdown.

(3) Fixed emergency communications independent of the normal plant communication system should be installed at preselected stations.

(4) A portable radio communications system should be provided for use by the fire brigade and other operations personnel required to achieve safe plant shutdown. This system should not interfere with the communications capabilities of the plant security force. Fixed repeaters installed to permit use of portable radio communication units should be protected from exposure fire damage. Preoperational and periodic testing should demonstrate that the frequencies used for portable radio communication will not affect the actuation of protective relays.

LGS Response:

All areas needed for the operation of safe shutdown equipment and the access and egress paths thereto are provided with two diverse emergency lighting systems, an AC system and an AC/DC system. The AC system is fed from the four diesel generator busses. The DC feed to the AC/DC system is from the BOP battery. The chargers for this battery are fed from a diesel generator bus, therefore, DC emergency lighting will be provided indefinitely during loss of offsite power. The AC and DC emergency lighting levels are shown in FSAR Table 9.5-12 for all safety related areas. Table 9.5-13 will be revised to show the areas needed for operation of safe shutdown equipment and the lighting levels provided.

Where the DC emergency lighting system does not provide at least 1/2 foot candle in these areas, self-contained 8-hour battery powered lighting units will be provided.

The routing of all emergency lighting circuits has been reviewed to assure that at least one of the emergency lighting systems will be available in these areas regardless of fire location.

This design assures that emergency lighting is available in all areas. The Limerick emergency lighting design is equivalent to the emergency lighting requirements of the above cited BTP section.

References:

1. LGS FSAR Section 9.5.3
2. LGS FSAR Table 9.5-12
3. LGS FSAR Questions 430.65 through 430.69

NRC Open Item #18: System Piping Connections

Pressure for the fire protection water system is provided by a 2 in. connection to the service water system. This does not meet our guidelines in Section C.6.b(4) of BTP CMEB 9.5-1. We require the applicant to provide a separate jockey pump to maintain pressure.

CMEB Position

The fire main system piping should be separate from service or sanitary water system piping, except as described in Position C.5.c(4).

LGS Response

The fire protection water system does not include any piping that also functions as part of the service water or sanitary water systems. The 2-inch line that provides pressure maintenance for the fire protection water system is part of that system only and has no function in the operation of the service water system. This design is in conformance with Section C.6.b(4) of BTP CMEB 9.5-1.

The pressure-maintenance feature of Limerick's fire protection water system is designed in accordance with NFPA 20, in that the 2-inch connection from the service water system meets the requirements and function of a supply from a pressure-maintenance pump having the required rated capacity not less than the normal leakage rate and having a discharge pressure sufficient to maintain the desired fire protection system pressure. The water source for the service water system is the cooling tower basin, which is the same water source that the fire pumps utilize.

The service water system serves as a highly reliable source of pressure, in that (a) connections are provided between the fire protection system and both the Unit 1 and Unit 2 service water systems, and (b) each service water system includes three 50% capacity service water pumps. This design results in a more reliable pressure source than would be provided by a jockey pump.

The maximum pressure that is expected to occur in the service water system is 141 psig at pump shutoff head. Since the design pressure of the fire protection piping is 175 psig no overpressure condition will exist.

Should one of the check valves in either 2-inch pressure maintenance line fail to shut on startup of the fire pumps sufficient pressure and capacity would still be available to

provide an effective hose stream or automatic suppression system operation in an area containing safety related equipment. Each pump has sufficient capacity and head such that the small loss of water thru the 2-inch connection is of no consequence.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section E.2(c)

2. Branch Technical Position CMEB 9.5-1, Section C.6.b

NRC Open Item #19: Valve Supervision

Supervision has not been provided for all valves in the fire protection water supply in accordance with NFPA 26.

CMEB Position

To meet our guidelines, in Section C.6.c of BTP CMEB 9.5-1 the type of valve supervised and the frequency at which its position is verified should be as listed below.

Type of Valve	Type of Supervision	Frequency of Inspection with Written Record
Post-indicator valves	*	every 7 days
Sectional control valves	*	every 7 days
Valves in the suction and discharge piping of the fire pumps	*	every 7 days
Valves controlling water supply to aqueous fire suppression or manual hose station standpipe systems	**	every 30 days

* Sealing valves so that the valve cannot be operated without breaking seals. Seals should be of a character to prevent injury in handling and prevent reassembly when broken.

**Electrically in accordance with NFPA 26 with electrical supervisory signals annunciated in the control area.

LGS Response

Control and sectional valves in the fire protection water system are either electrically supervised or administratively controlled. The features that provide the electrical supervision or administrative control, and also the inspection program that will be implemented for the two categories of valves, are described below.

The valves that will be electrically supervised are those valves that control the water supply to fixed (water) suppression systems and the valves that control the water supply to standpipe systems and to groups of manual hose stations. These valves are shown in FPER Figure B-2. The electrically supervised valves are provided with normally

open contacts that close in the event of valve movement. The electrical supervision signal is indicated at fire protection alarm panel 00C926, located near the entrance to the control room, and is annunciated inside the control room. Each of the electrically supervised valves will be inspected in accordance with the Limerick Technical Specifications.

The valves that will be administratively controlled are the valves in the suction and discharge of the fire pumps, plus the post indicator valves in the yard area that provide for sectional control of the fire main loop and control of the fire water headers branching into the various structures. These valves are padlocked in the open position so that they cannot be operated without breaking the padlocks. Padlocks are of a frangible design. Each of the administratively controlled valves will be inspected in accordance with the Limerick Technical Specifications.

Thus LGS design provides appropriate supervision of the fire protection system control and sectionalizing valves.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section E.2.

2. Branch Technical Position CMEB 9.5-1, Section C.6.c.

NRC Open Item #21: Hose Station Coverage

Manual hose stations are not located throughout the plant in accordance with NFPA 14.

CMEB Position

We will require the applicant to provide sufficient hose stations to enable the fire brigade to reach any location that could present a fire exposure hazard to safety related equipment with at least one effective hose stream.

LGS Response

Clarification on the provisions for hose stations in the areas of concern is provided below:

1. Reactor Enclosure

   a. Elevation 177ft:- Manual hose stations will be provided on El. 177 ft. in fire zone 40 and in the stairwell adjacent to fire zone 33 in Unit 1 and in fire zone 63 and in the stairwell adjacent to fire zone 56 in Unit 2.

   b. Elevation 313 ft; Fire Zones 49 and 72:- Hose stations 1HR-207 in Unit 1 and 2HR-207 in Unit 2 are capable of providing coverage of fire zones 49 and 72. An additional 50-foot length of hose is stored in the vicinity of each of the above hose stations to provide the necessary hose reach.

   c. Elevation 331 ft. - Manual hose stations will be provided on El. 331 ft. in fire zones 50A and 73A.

2. Radwaste Building

   Elevation 195 ft; Fire zones 119A through H:- Table A-1 of the FPER indicates that no suppression capability is available for these areas. This is incorrect. The hoses from manual hose stations OHR-303 and OHR-304 (located in fire zone 118B) can be used for fire suppression in fire zone 119. Table A-1 will be revised to show manual suppression for this area.

3. Service Water Pipe Tunnel

   Elevation 198ft; Fire zone 75: - Table A-1 of the FPER indicates that manual hose stations are available for

use in this area. The hoses from 1HR-240 and 2HR-240 (located in fire zones 42 and 65) can be used for fire suppression in fire zone 75. An additional 50 foot length of hose is stored in the vicinity of each of the above hose stations to provide the necessary hose reach. Thus adequate manual suppression is provided as there are no in-situ combustibles in this tunnel.

4. Turbine Building

   a) Elevation 200 ft; Fire zone 88A:- The condenser and feedwater areas are protected by a wet pipe sprinkler system and do not present a fire exposure hazard to safety-related equipment. Therefore manual hose coverage is not required for fire zone 88A.

   b) Elevation 217 ft. Fire zone 91:- The air ejector and steam packing exhauster compartment does not present a fire exposure hazard to safety-related equipment. Therefore, manual hose coverage is not required for fire zone 91.

   c) Elevation 200 ft; Fire zone 101A:- Same response as given in 4.b above.

   d. Elevation 217 ft: Fire zone 104A:- Same response as given in 4.b above.

5. Diesel Generator Enclosure

   Fire zones 79 through 86:- The diesel generator cells are protected by pre-action sprinkler systems. The fire hose required is met by the fire hydrants Nos. 8 and 9, with two hoses available from each hydrant.

← A field walkdown has verified the capability to provide an effective hose stream in all areas containing safety related equipment using the hose reels and additional lengths of stored hose.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Sections E.2.g & E.3

2. Branch Technical Position CMEB 9.5-1, Section C.6.c.4

NRC Open Item #27: Suppression in Control Room Ceiling

Automatic suppression systems are not provided for the electrical cabling routed through the space above the suspended ceiling in the control room.

CMEB Position

We will require the applicant to provide an automatic fire suppression system above the control room ceiling to meet Section C.7.b of BTP CMEB 9.5-1.

LGS Response

Automatic suppression systems are not provided for the electrical cabling routed through the space above the suspended ceiling in the control room for the following reasons:

1. The fire loading above the suspended ceiling is very light and gives an equivalent severity of only seven minutes. No transient combustibles are considered credible above the suspended ceiling since the only available access to this area is through use of a ladder. Catwalks or storage areas above the ceiling are not provided.

2. No power cables are routed through the space above the suspended ceiling. Only control and instrumentation cables are present, therefore the probability of a fire generated by an overload and faulted cable is considered to be extremely low because this scenario would require the simultaneous failure of two overcurrent protective devices. All cables routed in the trays have 600V insulation and contain 125VDC or 120VAC circuits. The 277V lighting circuits are all routed in conduit and are the highest voltage circuits routed above the suspended ceiling.

3. No safety related cables are routed in the cable trays above the suspended ceiling. All safety related cables are routed in fully enclosed gutter or conduit.

4. All cable trays will be fully enclosed with steel top and bottom covers. Cable dropouts through the tray bottoms will be sealed with thermal ceramic fiber with a flame retardant mastic coating. This will assure that any fire originating in the tray is contained within the tray. The cross sectional area of these trays is 0.66 ft^2.

5. Since Limerick uses IEEE-383 qualified cable and completely meets the requirements of Regulatory Guide 1.75 concerning cable tray separation, any fire that does occur in a tray above the suspended ceiling will be limited to the tray in which the fire starts. This is based on the fire tests conducted by Sandia as described in Ref. 3.

6. Ten smoke detectors are located above the suspended ceiling to provide prompt indication of a fire.

7. Two portable ladders will be located immediately outside the control room access doors to provide access to the area above the suspended ceiling for manual fire fighting.

8. The individual panels of the suspended ceiling are easily removable to provide access.

9. Portable fire extinguishers are located in the control room and CO_2 hose reels are located immediately outside the control room access doors to provide a manual fire fighting capability.

10. The control room is continuously manned, therefore prompt response to any alarm indicating a fire above the suspended ceiling is assured.

Based on the above, it is concluded that manual suppression provides an acceptable alternative to the installation of an automatic fire suppression system.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section F.2

2. Branch Technical Position CMEB 9.5-1, Section C.7.b

3. NUREG/CR-2931 Burn Mode Analysis of Horizontal Cable Tray Fires.

11. ALL COMPONENTS OF the false CEILING WERE PURCHASED/DESIGNED to 1-HOUR fire RESISTANCE REQUIREMENTS EXCLUDING the INTERFACE of the false CEILING AND ANNUNCIATOR PANELS.

Item 34: Cooling Towers

The cooling towers are constructed using combustible PVC material. This does not meet the guidelines of BTP CMEB 9.5-1, Section C.7. The sole source of fire suppression water is provided from the cooling tower basins.

CMEB Position

We require that automatic suppression system be provided in accordance with the guidelines of NFPA 214-1977 and Section C.7.g of BTP CMEB 9.5-1.

LGS Response

FPER Section 3.1.2, Item 247, describes the construction of each cooling tower. The American Nuclear Insurers (ANI) accepted the cooling tower design without a sprinkler system after a successful large scale burn test was conducted by Marley in July 1978 and witnessed by ANI.

Loss of a hyperbolic natural draft cooling tower due to a fire can only occur when the Unit associated with that cooling tower is shutdown and no water is flowing through the tower over the combustible fill material. Loss of a cooling tower will not result in the loss of the water source for the fire pumps as each pump is provided with the capability of taking a suction on the circ.water suction line from each cooling tower. Therefore, if one tower and basin cannot be used, the pumps will be capable of taking a suction on the tower and basin that is in use.

Based on the test conducted by Marley and the design provisions discussed above, the cooling tower design is acceptable.

References

1. Branch Technical Position ASB 9.5-1, Appendix A, Section F.17

2. Branch Technical Position CMEB 9.5-1, Section C.7.g