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REGION III

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Licensee: Commonwealth Edison Company

Facility: Braidwood Nuclear Power Plant

Location: RR #1, Box 84
Braceville, IL 60407

Dates: October 13, 1996 through March 12, 1997

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EXECUTIVE SUMMARY

Braidwood Nuclear Station Units 1 and 2 NRC Inspection Report 50-456/96016(DRS); 50-457/96016(DRS)

This regional inspection reviewed the licensee's fire protection program and several Appendix R issues. The following strengths and weaknesses were identified:

Plant Support

- An unresolved item was identified concerning the licensee's interpretation of the design basis for hot shorts in motor-operated valve control circuits that occur during a control room fire (Section F1).
- Control of combustibles and material condition of fire protection equipment were good (Section F2.1).
- An unresolved item was identified concerning the design basis of the reactor coolant pump oil collection system (Section F2.2).
- The licensee identified, during Thermo-Lag resolution activities, that several incorrect cable separation assumptions could potentially result in the inability to achieve and maintain safe shutdown conditions if a fire occurred in certain fire zones. This is an apparent violation (Section F2.3).
- The licensee identified that the roll-up doors, separating various equipment rooms and the Turbine Building, were inoperable and did not meet the 3-hour rated fire barrier requirement. This condition existed since 1991 for Unit 1 and since plant construction for Unit 2. This is an apparent violation (Section F2.4).
- One violation of Technical Specification 6.8.1 was identified where the licensee failed to properly fill out Hot Work Permits on numerous occasions (Section F3).
- Two weaknesses concerning fire brigade training were noted. The first weakness concerned the large number of personnel involved in each fire drill which reduced individual participation in the drill. The second weakness involved the lack of information exchanged during drill critiques (Section F5).
- The inspectors identified weaknesses in the use of fire watches in lieu of permanent corrective actions (Section F6).
- One unresolved item was identified concerning the licensee's use of high energy line break (HELB) watches to close the fire doors between Auxiliary and Turbine Buildings in case of an HELB in the Turbine Building (Section F8).

Report Details

IV. Plant Support

F1 . Control of Fire Protection Activities

F1.1 Motor-Operated Valve (MOV) Hot Shorts

a. Inspection Scope

The inspectors reviewed the licensee's response to Information Notice (IN) 92-18, Braidwood Safety Evaluation Reports (SERs), and the Braidwood Fire Protection Report.

b. Findings and Observations

On February 28, 1992, the NRC issued Information Notice (IN) 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire." This IN identified a potential common mode failure of MOVs in which a postulated fire could cause hot shorts in the valve control circuit and bypass the valve protective features (i.e., limit and torque switches). The spurious operation of the MOVs could cause physical damage to the valves which were required to be operated to achieve and maintain safe shutdown conditions.

The licensee's initial evaluation of IN 92-18 was performed in 1992. The licensee elected not to take corrective actions because a fire in the control room was considered a low probability event. After the NRC identified that other RIII licensees' responses to IN 92-18 were not adequate, Braidwood initiated further MOV evaluations. The evaluations indicated that no pressure boundary would be violated as a result of fire induced MOV damage. However, 50 valves were identified as susceptible to hot shorts. The licensee did not take corrective actions for the majority of the valves because the licensee assumed only one spurious actuation and the availability of redundant equipment.

The licensee indicated that, except for high-low pressure interfaces, Byron and Braidwood SER commitments for safe shutdown were approved for one spurious actuation. In addition, the licensee stated that the guidance of Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements," was correctly interpreted and implemented. Therefore, a spurious actuation was not a safe shutdown problem because redundant components would be available due to adequate separation, and procedures were in place to accommodate each singular hot short.

The following Byron SSER 5 (the same SSER applies to Braidwood) statement was used by the licensee to support their position:

"The applicant also performed a detailed analysis of circuits whose fire-induced spurious operation could adversely impact safe shutdown. This analysis included a review of high-low pressure interfaces. For each fire zone, the applicant's analysis assumed all equipment and circuits located in

the fire zone were unavailable and one spurious actuation resulted from the fire. The applicant's analysis demonstrated that through the fail-safe design of air-operated valves or with manual operation of components, post-fire safe shutdown would not be adversely impacted. For the high-low pressure interface of the Reactor Heat Removal (RHR) pump suction lines, the applicant demonstrated that adequate separation of the valve control circuits and pressure interlock circuits existed to ensure one valve of the redundant valves in series would not spuriously operate due to fire damage in any one fire area. For the concern of spurious operation of the pressurizer Power Operated Relief Valves (PORV's), the applicant has committed to prevent or mitigate the spurious operation of these valves by either 1) isolating the valves prior to an occurrence of a fire, 2) providing electrical isolation or 3) providing a means to detect and defeat any spurious operations."

The licensee stated that they comply with GL 86-10, Question 5.3.10, which stated the following: "Per the criteria of Section III.L of Appendix R a loss of offsite power shall be assumed for a fire area concurrent with the following assumptions: a) The safe shutdown capability should not be adversely affected by any one spurious actuation or signal resulting from a fire in any plant area; b) The safe shutdown capability should not be adversely affected by a fire in any plant area which results in the loss of all automatic function (signals, logic) from the circuits located in the area in conjunction with one worst case spurious actuation or signal resulting from the fire; and c) The safe shutdown capability should not be adversely affected by a fire in any plant area which results in spurious actuation of the redundant valves in any one high-low pressure interface line."

The licensee stated that mechanical damage to multiple valves during hot shorts was a new condition not assumed in the original design bases or required by any NRC correspondence. In addition, the licensee stated that no actions were required by IN 92-18 and that the need to consider multiple spurious actuations of MOVs constituted the imposition of a new requirement not previously imposed by the NRC.

The licensee had identified several valves that require modifications or procedural changes to prevent or mitigate hot shorts. The corrective actions for these valves will be completed in 1997. The licensee's position that Braidwood's design basis only included one hot short and did not include the need to account for mechanical damage to multiple valves has been forwarded to the Office of Nuclear Reactor Regulation (NRR) for review. This is an unresolved item (URI 50-456/457/96016-01(DRS)).

c. Conclusion

An unresolved item is identified concerning the licensee's interpretation of the Braidwood Appendix R design basis for MOV hot shorts during a control room fire.

F.2 Status of Fire Protection Facilities and Equipment

F2.1 Observation of Plant Areas

a. Inspection Scope

The inspectors toured the auxiliary and turbine buildings to observe the control of combustibles, fire doors, hose stations, detection equipment, extinguishers, sprinkler systems, emergency lights, and housekeeping.

b. Observations and Findings

Control of combustibles was good with few transient combustibles noted in the plant. Flammable liquids were stored appropriately in fire proof cabinets and safety cans. There was a minimal amount of oil below rotating equipment.

The material condition of the fire suppression and detection equipment was good. Fire brigade equipment was in good condition and was stored in locked cages in convenient locations in the plant. Most fire doors in the plant were in good condition. Only a few doors did not latch when they self-closed. Impaired doors were being tracked by fire protection personnel. However, an impaired fire door condition that existed for almost six years is described in Section F8.

The diesel fire pump's reliability was substantially improved after it was placed on the A-1 maintenance list. Zebra mussels were being monitored and were not a problem.

One concern identified during the previous fire protection inspection was the large amount of anti-contamination clothing stored below a cable tray containing safety related cables in the Auxiliary Building. This condition was contrary to Branch Technical Position 9.5.1 because no automatic fire suppression system was provided for the cable trays with combustibles stored nearby. During this inspection, the inspectors noted that the majority of the anti-contamination clothing had been relocated away from this area. The remaining clothing was in metal bins with metal covers.

c. Conclusion

Control of combustible material in the plant appeared to be good. Material condition of the fire suppression and detection equipment was also good. One deficiency noted during the previous inspection concerning the storage of anti-contamination clothing was corrected.

F2.2 Reactor Coolant Pump Oil Collection System

a. Inspection Scope

The inspectors reviewed the documentation and scope of a modification to add additional oil collection pans to the Reactor Coolant Pumps.

b. Observations and Findings

The licensee determined that the Reactor Coolant Pump (RCP) oil collection system at Byron and Braidwood required additional oil collection pans. The current oil collection system had 5 drain pans. Two additional drain pans were being added and a drain pan was lengthened for each Reactor Coolant Pump. An Operability Assessment was completed at Braidwood on June 28, 1996, to document continued operability of both Units. The Unit 2 modification was completed. The Unit 1 modification will be completed during the next refueling outage.

Appendix R, Section O, states, "Such collection systems shall be capable of collecting lube oil from all potential pressurized and unpressurized leakage sites in the reactor coolant pump lube oil systems." It appeared to the inspectors that the as-found oil collection systems were not capable of collecting oil from all potential leakage sites. The inspectors considered this condition as not being in full compliance with Appendix R, Section O, and, therefore, outside the licensee's design basis. However, from March 1996 to March 1997, the licensee failed to notify the NRC of this condition as required by 10 CFR 50.73. The licensee disagreed that this was a condition that was outside the plant design basis. This is an unresolved item pending NRC review (URI 50-456/457/96016-02(DRS)).

c. Conclusions

An unresolved item was identified concerning the licensee's RCP oil collection system design basis.

F2.3 Appendix R issues

a. inspection Scope

The licensee identified several Appendix R deficiencies as part of an effort to evaluate Thermo-Lag installations throughout the plant in response to Generic Letter 92-08. A Thermo-Lag resolution plan was formulated to re-analyze areas where Thermo-Lag was installed. The licensee reevaluated the safe shutdown analysis for 11 affected fire zones for both units. After completion of this effort, the licensee developed the Appendix R Enhancement Plan to review the current safe shutdown analysis. This effort included 100 percent cable routing verification and documentation of design basis and assumptions.

The inspectors reviewed the Braidwood Fire Protection Report and Appendix R Enhancement Plan; LER 95013, Revision 0, dated November 9, 1995, and Revision 1, dated July 3, 1996; Plant Identification Form (PIF) 456-180-95-013; PIF 456-180-95-013S1; and a licensee letter, dated June 12, 1996, addressing safe shutdown analysis deficiencies.

b. Observations and Findings

Units 1 and 2 Miscellaneous Electric Equipment Room (MEER) Supply Fans

On October 8, 1995, the licensee identified that a fire in Fire Zones 11.5-0 or 11.6-0 could render both Units 1 and 2 MEER supply fans inoperable. This was contrary to the assumptions made in the Braidwood Fire Protection Report (FPR) Safe Shutdown Analysis. Fire Zones 11.5-0 and 11.6-0 contained MCCs 132X5 and 232X5, which shared common source breakers with MEER supply fans. A fire in the zones could render MEER supply fans unavailable due to opening of the source breakers.

The equipment in Train A MEERs for both units was cooled by ESF switchgear room fans and assumed not protected according to the safe shutdown analysis (SSA). The equipment in Train B MEERs was cooled by MEER supply fans and considered protected. A postulated loss of Train B MEER supply fans would result in a loss of DC power and instrument buses to the main control room (MCR) and remote shutdown panels. In addition, the control power to 4160 and 480 volt switchgear would not be available. If a loss of DC power condition existed, the licensee could use fire hazards panels (FHP) and existing plant procedures BwOA-ELEC-5, "Local Emergency Control of Safe Shutdown Equipment Unit 1," to achieve safe shutdown conditions.

The licensee had existing hourly fire watches for these zones when the deficiency was identified. The licensee added breakers so that the MCCs and MEER supply fans had separate source breakers. Therefore, a fire in Fire Zone 11.5-0 or 11.6-0 would no longer cause the loss of supply fans for Train B MEERs. This deficiency did not adversely affect the licensee's capability to achieve and maintain safe shutdown conditions.

Loss of Unit 1 Emergency Diesel Generators (EDGs)

On October 20, 1995, the licensee identified that a fire in Fire Zone 11.5-0 would render 1A EDG inoperable because the potential transformer (PT) and current transformer (CT) cables were not protected with a 1-hour rated fire barrier in the zone. These cables were associated with operations of the EDG electronic governor and automatic voltage regulator. Fire Protection Report, Section 2.4.2.45, assumed 1A EDG was protected in this zone but did not recognize that these cables were also required for operation of 1A EDG. Although the PT and CT cables for 1B EDG were not routed through the same zone, unprotected power and control cables for 1B EDG fuel transfer pumps were routed through the same fire zone. In addition, a fire in this zone would affect offsite power because cables associated with SAT cooling fans were routed through the same zone. A fire in this zone could cause a Unit 1 station blackout.

In addition, the licensee identified that control cables 1DG157 and 1DG175 for 1A EDG were not protected with a 1-hour rated fire barrier in Fire Zone 3.2A-1. A fire in this zone would render both Unit 1 EDGs inoperable. The licensee indicated that the nonsegregated bus duct and control cables to the ESF bus breakers were routed through the same fire zone. Therefore, a fire in either Zone 11.5-0 or 3.2A-1 would

result in loss of onsite and offsite power for Unit 1. The licensee could use an existing procedure to cross-tie power from Unit 2 and achieve safe shutdown conditions.

The licensee had existing hourly fire watches for these zones when the deficiencies were identified. In November 1995, the licensee rerouted the affected cables out of the fire zones.

Essential Service Water (SX) Pump

Fire Protection Report Section 2.4.2.34 assumed that 1A SX pump was protected and could be operated locally at the switchgear if a fire occurred in Fire Zone 11.3-0. However, the licensee identified that the 1A SX pump may not be available after a fire in the zone because part of the pump power cable was not protected with a 3-hour rated fire barrier. A fire in this zone would render both 1A and 1B SX pumps unavailable resulting in a loss of all cooling capability and the loss of ultimate heat sink for Unit 1. The licensee could use BwOA PRI-8, "Essential Service Water Malfunction," to start a Unit 2 SX pump and open cross-tie valves to supply cooling water to Unit 1 through the essential service water header. Therefore, safe shutdown conditions could be achieved and maintained.

The licensee had existing fire watches for this zone when the deficiency was identified. In October 1996, the licensee rerouted the 1A SX pump power cable out of the zone.

1B Auxiliary Feedwater (AF) Pump

FPR Section 2.4.2.50 assumed that both 1A and 1B AF pump cables were routed through Fire Zone 11.6-0 and that the 1B AF pump was protected. However, the licensee did not recognize that control cables 1AF338 and 1AF346 were essential for operation of the 1B AF pump from the emergency control panel. During the Thermo-Lag resolution effort, the licensee identified that these control cables were not protected with a 3-hour rated barrier in Fire Zone 11.6-0. These control cables were associated with the low-low suction pressure pump trip signal. Fire damage to these unprotected control cables would render the 1B AF pump unavailable since the pump could not be started locally from the emergency control panel outside the AF pump room. Therefore, a fire in this zone could render both 1A and 1B AF pumps inoperable. The licensee indicated that offsite power would not be available because cables associated with SAT cooling were routed through the zone. Since offsite power would not be available to the main feedwater pumps, the licensee could not achieve and maintain safe shutdown conditions upon a loss of the Unit 1 AF system.

The licensee had existing hourly fire watches in place when the deficiency was identified. In November 1995, the licensee made a logic change so that the control cables would not affect the ability to start the 1B AF pump at the emergency control panel outside the AF pump room. The AF system was a system required for achieving hot standby condition. This deficiency affected the licensee's ability to achieve and maintain safe shutdown conditions.

Loss of Unit 1 Fire Hazard Panel

On June 4, 1996, the licensee identified that a fire in Fire Zones 3.2A-1, 3.2B-1, or 11.5-0 could render both trains of control room ventilation (VC) system and the Unit 1 FHP unavailable. The loss of VC system would result in instrumentation and control in the main control room and at the remote shutdown panels becoming inoperable. For these affected zones, the licensee initially assumed in the FPR that VC suction and discharge dampers would fail partially open. The licensee concluded that only manual operation of the unaffected fan was required to restore VC system and the system would still be available during a fire in these zones. However, the licensee later determined that the discharge dampers would fail closed and prevent system flow. No procedures were in place to direct operators to manipulate the dampers during this condition. The existing FPR bounded the consequences of the loss of ventilation to the MCR and Auxiliary Electric Equipment Room (AEER) assuming instrumentation at the FHP was available. However, with Division 12 power system cables routed through the same zones and not protected, power supply to Unit 1 FHP would not be available. The licensee concluded that the capability to shut down Unit 1 could not be demonstrated.

For Fire Zone 3.2A-1, the compensatory actions included:

- Making part of the affected zone a transient combustible and hot work exclusion area; and
- Providing shift briefing and procedural guidance to direct operators to open two VC dampers and control room doors and operate VC supply fan OVC01CA at the breaker.

For Fire Zone 3.2.B-1, the compensatory actions included:

- Making part of the affected zone a transient combustible and hot work exclusion area;
- Providing shift briefings of equipment status to operators; and
- Placing the switches at the local panel for Fans IVX01C and 1VE01C in the local position.

For Fire Zone 11.5-0, the compensatory actions included:

- Establishing a dedicated fire watches in this zone; and
- Providing temporary procedures and shift briefing to direct operators to manually restore Train A control room ventilation.

In July 1996, the licensee routed an alternate power source for the Unit 1 FHP from a Division 11 power source. Therefore, at the Unit 1 FHP, operators could choose the power supply from either Division 11 or 12. In addition, in December 1996, the licensee created BwOP VC-18 to provide guidance to operators for restoring one train of the VC system.

Loss of Unit 2 Fire Hazard Panel

On June 4, 1996, the licensee identified that a fire in Fire Zone 11.4-0 could render the VC system and Unit 2 FHP unavailable. For a fire in the zone, the VC supply and return fans and redundant dampers would be disabled. The existing FPR bounded the consequences of the loss of ventilation to the MCR and AEER assuming instrumentation at the FHP was available. However, with Division 22 power cables unprotected and routed through this fire zone, Unit 2 FHP would not be available. The licensee concluded that the capability to safely shut down Unit 2 could not be demonstrated. The licensee's compensatory actions included:

- Establishing dedicated fire watches in this zone;
- Providing temporary procedure to operators for manually restoring Train A of the control room ventilation system; and
- Conducting shift briefings of equipment status and consequences of a fire in this zone.

In July 1996, the licensee made a modification to provide an alternate power source for the Unit 2 FHP from a Division 21 power source. In addition, the licensee procedurized the steps required for restoring one train of the VC system.

Other Affected Zones Associated With VC System

In addition to the above deficiencies, the licensee identified that in the event of a fire in Fire Zones 2.1-0, 11.4C-0, or 11.6-0, the VC system would not be available. The existing FPR bounded the consequences of the loss of ventilation to the MCR and AEER assuming instrumentation at the FHP was available. The licensee concluded that instrumentation required to shut down the units would be available at the FHPs. Therefore, these deficiencies would not affect the licensee's capability to achieve and maintain safe shutdown conditions. The licensee initiated an engineering request to evaluate the need to move the controls and instrumentation of one train of the VC system from the current remote shutdown panels to another location.

c. Conclusion

The licensee identified that a fire in either of five zones (3.2A-1, 3.2B-1, 11.4-0, 11.5-0, or 11.6-0) would affect the ability to achieve and maintain safe shutdown conditions. Specifically, the findings were summarized as follows:

- A fire in Fire Zone 3.2A-1 would render the VC system, Unit 1 FHP, Unit 1 EDGs, and offsite power inoperable.
- A fire in Fire Zone 3.2B-1 would render the VC system and Unit 1 FHP inoperable.
- A fire in Fire Zone 11.4-0 would render the VC system and Unit 2 FHP inoperable.

- A fire in Fire Zone 11.5-0 would render the VC system, Unit 1 FHP, Unit 1 EDGs, offsite power, and MEER supply fans inoperable.
- A fire in Fire Zone 11.6-0 would render the VC system, Unit 1 AF system, offsite power, and MEER supply fans inoperable

The licensee also identified three zones in which equipment could be damaged but would not affect the ability to achieve safe shutdown conditions.

- A fire in Zone 11.3-0 would render both Unit 1 essential service pumps inoperable.
- A fire in Zone 2.1-0 would render the VC system inoperable.
- A fire in Zone 11.4C-0 would render the VC system inoperable.

10 CFR 50, Appendix R, Section III.G requires, in part, that 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. Section III.G.2 requires that, except as provided in Section III.G.3, where cables of equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are in the same fire area, separation of cables of redundant trains by a fire barrier having a 3-hour rating or 1-hour rating with fire detector and an automatic suppression system shall be provided. Failure to provide separation of cables of redundant trains as evidenced by the above examples is an apparent violation of 10 CFR 50, Appendix R, Section III.G.2 (EEI 50-456/457/96016-03).

F2.4 Roll-up Door Problems

a. Inspection Scope

The inspectors reviewed the licensee's corrective actions for problems identified with roll-up doors installed between the Turbine Building and the Auxiliary Building. This was a followup inspection for Unresolved Item (50-456/457/96014-05 (DRS)). On July 3, 1996, mechanical maintenance personnel performed surveillance BwMS 3350-001, "Fire and Security Door Semi-Annual Inspection," Revision 0. Several roll-up fire doors did not go closed as expected with outside air ventilation supplied to the room.

The main function of the roll-up doors was to roll down completely during a fire so as to prevent the fire from affecting redundant safe shutdown equipment. Unit 1 doors were installed during a modification to prevent nuisance security alarms due to fluctuations in the ventilation systems. Unit 2 doors were installed during initial construction. The Braidwood Fire Protection Report identified the roll-up doors as required 3-hour fire barriers. The roll-up doors separated the following rooms from the turbine building:

- 1A & 1B diesel generator rooms
- 2A & 2B diesel generator rooms
- Unit 1 Division 11 & 12 ESF switchgear rooms

Unit 2 Division 21 & 22 ESF switchgear rooms
Unit 1 non-ESF switchgear rooms
Unit 2 non-ESF switchgear rooms
Unit 1 miscellaneous electric equipment rooms
Unit 2 miscellaneous electric equipment rooms

All doors, except the EDG room doors, were normally left open to equalize the pressure between the auxiliary building spaces and turbine building.

The inspectors reviewed BwMS 3350-001, "Fire and Security Doors Semi-Annual Inspection"; BwAP 1110-3, "Plant Barrier Impairment Program," Revision 3; BwAP 1100-8, "Fire Protection Program System Requirements," Revision 5; Problem Identification Forms 456-120-96-011 and 450-201-96-2158; and Calculation 3C8-0691-001.

The licensee identified additional problems during review of the roll-up door failures to close. Those problems are identified below.

b. Observations and Findings

b.1 Wrong Doors Purchased

Some roll-up doors failed to close against a differential pressure during subsequent testing. This problem may be applicable to other untested doors. The requirement to operate across a differential pressure was not part of the specification on the purchase orders.

b.2 Incorrect Installation of Doors

On October 1, 1996, the licensee identified that the original installation of the roll-up doors was not according to the manufacturer's requirement and concluded that the doors would not meet the 3-hour fire rating. The angle irons for mounting the doors contained bolt slots for iron expansion during a fire. The contractor mistakenly used the bolt slots for adjustment purposes to miss the reinforcement bars in the concrete walls. Bolts at the ends of the slots would prevent the iron from expanding and would subsequently deform the doors during a fire. In addition, there were no clearances between the angle irons and the floor for expansion. The licensee wrote PIF 456-201-96-2158 documenting this installation discrepancy.

b.3 No Post-Modification Testing

The licensee identified that post-modification testing was untimely. The modification to the Unit 1 roll-up doors was completed in 1991. The licensee delayed the post-modification testing due to a lack of management direction and low priority. In addition, no installation tests were performed on the Unit 2 roll-up doors during plant construction. In 1994, the licensee identified that the roll-up doors were not tested before they were placed in operation. A PIF was written to investigate the process that allowed the implementation of design changes without testing.

b.4 Inadequate Surveillance Procedures

The licensee identified several discrepancies in BwMS 3350-001, "Fire and Security Doors Semi-Annual Inspection," Revision 0. Examples of procedural discrepancies included:

- The procedure did not specify and require documentation of ventilation status.
- The procedure did not require personnel to reset the spring tension at the end of the test as required by vendor's information.
- The procedure did not include a closure time requirement of 1 to 2 seconds as assumed in the High Energy Line Break (HELB) analysis.

b.5 Surveillance Closed as Complete

The licensee identified that roll-up door surveillances were signed off as complete even though the roll-up doors did not fully close. The licensee stated that the maintenance staff believed that the surveillance only tested the integrity of the door and that a ventilation problem prevented the door from closing on its own. However, the surveillance specifically required that the door should close smoothly and completely. During surveillance testing, maintenance personnel pushed the door down manually to complete the test. The inspectors identified that the maintenance staff had many opportunities to identify the roll-up doors problems during surveillance testing, but failed to identify the failure of the doors to meet surveillance requirements.

b.6 Untimely Compensatory Measures

The licensee issued PIF 456-201-96-1532 five days after identification of the July 3, 1996, failure of the roll-up fire doors to close during surveillance testing. As a result, the doors were not closed immediately to protect safe shutdown equipment. In addition, the licensee did not initiate plant barrier impairments for two months due to a lack of communication between the maintenance and engineering staff.

b.7 Incorrect Assumptions in High Energy Line Break Analysis

On September 3, 1996, the licensee identified that previous assumptions in the turbine building HELB analysis were not accurate. The licensee ensured that roll-up doors were kept closed so that plant equipment required for safe shutdown was protected from a HELB in the turbine building. The re-performed HELB analysis demonstrated that safe shutdown equipment would not have been effected by a HELB with the doors in the partially closed position.

b.8 Lack of Contractor Control

The inspectors identified that the licensee did not adequately control contractor activities associated with the original door installations.

The licensee initially allowed 12 roll-up doors to be incorrectly installed by the contractor. This problem was not identified for more than 6 years. During the original installation, the only quality control oversight provided was for holes drilled in the roll-up door supporting wall and for receipt inspection of roll-up door repair materials. Despite these earlier problems, the current contractor repairs to the doors were performed without a site procedure and utilized minimal work package guidance. Changes made to the doors as a result of repair activities were not formally documented. In addition, contractor preventive maintenance to the doors was not documented.

b.9 Engineering Knowledge Concerns

The inspectors identified, during interviews with licensee's engineering staff, that they did not understand the basic mechanical assemblies that made the roll-up doors operate, even though they had been working on the roll-up door issues for months. For example, the engineers did not know if the springs helped the door roll up or roll down. In addition, they did not understand the function of the ratchet mechanism. As a result, the technical problems and resultant quality of work for repair and preventive maintenance activities were the responsibility of the contractor.

b.10 Generic Implications Not Addressed

The inspectors identified that the licensee had not addressed the generic implications of the roll-up door failures to operate against a differential pressure. The licensee believed that a 10 CFR 50, Part 21 could not be issued because the differential pressure was not specified during the purchase of the doors. The licensee had not recognized that the doors sold by the vendor may not operate in other applications at other nuclear facilities. As a result, the licensee had not sent a message on the nuclear network to alert other licensees of potential roll-up door design problems.

b.11 No Preventive Maintenance

The inspectors identified that preventive maintenance was not evaluated or scheduled since the roll-up doors were originally installed, even though the function of the roll-up doors to close was important to the safe shutdown of the plant.

c. Conclusion

The major deficiency associated with the type of roll-up doors used by the licensee was that the slats that make up the door rub on the frame when there is a differential pressure (caused by ventilation systems) between the areas that the door protects. The doors do not have rollers on the outer edges of the slats. The friction increases as the door lowers because of the increased surface area of the slats in contact with the frames of the guide assembly. When the friction plus the spring tension from the counterbalancing pipe exceeds the weight of the door it stops. During initial purchase, the licensee did not identify differential pressure as a potential barrier to door closure. This was a basic design parameter that should

have been identified by the licensee. As a result, the doors were purchased and installed without taking the differential pressure into account.

The licensee did an excellent job of identifying the majority of problems related to the roll-up doors. In addition, the corrective actions were extensive. However, since 1991 for Unit 1 and plant construction for Unit 2, the roll-up doors were inoperable and did not meet the 3-hour rated fire barrier requirement. Therefore, a fire in the fire zones associated with the roll-up fire doors could have damaged redundant safe shutdown equipment. This was an apparent violation of 10 CFR 50, Appendix R, Sections III.G.2 (EEI 50-456/457/96016-04).

F3 Fire Protection Procedures and Documentation

a. Inspection Scope

The inspectors reviewed fire protection surveillances, maintenance history on fire protection equipment, fire brigade training and drill records, fire reports, hot work permits, deviation reports, work requests, safety evaluations, controls to prevent biological fouling by zebra mussels, and audits of fire protection activities.

b. Observations and Findings

A review of fire reports for the past three years indicated only a few fires involving hot work. This was an indicator of good transient combustible controls and safely performed hot work.

During a review of a sample of hot work permits, dated from January 16, 1996, to September 26, 1996, the inspector identified that the applicable portions of the hot work permits were not accurately filled out prior to work.

Some hot work permits did not identify the correct type of hot work. A large percentage of the hot work permits had blanks where data was required. Applicable precaution statements were not correctly identified in many cases. Non-applicable precautions were often marked. There were examples where the latest revision of the hot work permit was not used, so the latest precautions statements were not available to staff, i.e., precaution added as a result of a LaSalle hot work fire. Braidwood Technical Specification 6.8.1.a required that procedures be established, implemented, and maintained for activities covered in Appendix A of Regulatory Guide 1.33. Regulatory Guide 1.33, Appendix A, included fire protection procedures. The failure to correctly implement Braidwood Station Hot Work Permit, Attachment A of BwAP 1100-15 is a Violation of TS 6.8.1 (50-456/457/96016-05(DRS)). Although the few plant hot work fires that occurred during the last three years indicated good work practices, even without the exact controls implemented by the hot work permit, the inspectors were concerned that plant supervisors allowed the hot work permits to be improperly filled out. In addition, the fire protection staff did not take action to end this practice. The licensee took corrective actions for this problem during the inspection.

c. Conclusions

One violation was identified concerning the failure to properly fill out hot work permits.

F5 Fire Protection Staff Training and Qualification

a. Inspection Scope

The inspectors reviewed fire brigade training, qualification records, and fire brigade critiques.

b. Findings and Observations

A review of records indicated that the fire brigade was meeting its quarterly fire brigade training requirements. The records for the fire brigade were adequately maintained and indicated whether the brigade members were qualified.

A review of fire brigade critiques indicated several weaknesses. There were an excessive number of persons on each fire brigade drill. Many fire brigade drills had 12 to 14 participants. The majority of the individuals had little participation and training during a drill; however, these drills were given credit for the persons having met their fire drill requirement. A second weakness was that the fire brigade critiques identified very few problems during fire drills. There was little information provided for future training to improve fire brigade performance.

c. Conclusions

The inspectors identified two weaknesses concerning fire brigade training. The first weakness concerned the large number of personnel involved in each fire drill which reduced individual participation in the drill. The second weakness involved the lack of information exchanged during drill critiques.

F6 Fire Protection Organization and Administration

a. Inspection Scope

The inspectors reviewed the timeliness of the licensee's corrective actions in the fire protection area. In addition, the fire watch program was assessed.

b. Observations and Findings

The inspectors noted that the number of impairments had been reduced during the past year but was still high. Overall, there was a lack of timely corrective actions for plant barrier impairments and fire protection work request backlog. Some items dated back several years. Many impairments were only corrected during outages resulting in an increase in the number of impairments between outages.

The inspectors identified that the licensee used fire watches extensively for compensatory measures. This was also noted during the 1993 fire protection

inspection. The licensee's current practice was to have three roving fire watches cover the plant all of the time. The licensee did not consider new impairments a significant concern because the fire watches were already covering the affected areas. The lack of progress to take timely corrective actions to reduce the plant barrier impairments and fire protection work request backlog, and the extensive use of fire watches for compensatory measures was a program weakness.

The inspectors also identified a weakness with the fire watch program in that fire watches did not observe or know what the impairments were during their fire watch rounds. For example, by not knowing that a fire door was impaired the fire watch could not ensure that transient combustibles were kept away from the door. Any nearby combustibles could significantly increase the risks associated with the impaired door.

c. Conclusions

The inspectors identified weaknesses in the use of fire watches in lieu of permanent corrective actions.

F7 Quality Assurance in Fire Protection Activities

Audit investigations for fire protection were limited in scope. Very few fire protection field monitoring reports (FMRs) had been performed. The effectiveness of identifying problems in the fire protection program was questionable.

F8 Miscellaneous Fire Protection Issues

(Open) Violation 50-456/457/93022-01a(DRS): Untimely corrective actions for an impaired fire door between the auxiliary building and the turbine building. The site had exhaust and intake air fan problems in the auxiliary building resulting in air pressure imbalances since construction. A high differential pressure between the turbine building and the auxiliary building would cause the doors between the auxiliary and turbine building to slam excessively and be damaged. The doors were blocked open in March 1991 to partially equalize the air pressure between the areas. The licensee did not take any corrective actions to modify the fire door or resolve the ventilation problems prior to the 1993 fire protection inspection.

The door was still blocked open during this inspection. The inspectors noted that a permanent watch had been assigned to the blocked open door. The licensee stated that this watch was stationed as compensatory measure for a licensee identified high energy line break (HELB) concern. The watch was assigned to close the door during a HELB in the turbine building. As a result of concerns, the resident inspectors performed a followup inspection for this impairment. The results are documented in Inspection Report 50-456/457/96011.

The inspectors had a concern about the HELB watch's ability to close the impaired door during a HELB event and subsequent high temperature steam environment in the turbine building. Pending additional review this is considered an Unresolved Item (URI 50-456/457/96016-06(DRS)).

The licensee indicated that a modification will be completed during 1997. The modification would include the installation of fire dampers in a doorway between the auxiliary and turbine buildings to equalize the pressures between the areas.

Conclusions

The inspectors were concerned about the timeliness of corrective actions because the door had been impaired for six years. The violation (50-456/457/93022-01a(DRS)) for this issue will not be closed until the licensee completes the modification.

(Closed) Violation 50-456/457/93022-01b: Failure to identify and take corrective actions for a high failure rate of emergency lights. Effective corrective actions were taken for emergency lighting problems. The failure rate for emergency lighting during this inspection was very low. This violation is closed.

V. Management Meetings

X1 Exit Meeting Summary

On March 12, 1997, the inspectors presented the inspection results to licensee management. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

M. Anjum, System Engineer
B. Boyle, Assistant Fire Marshal
M. Cassidy, Regulatory Assurance - NRC Coordinator
D. Christiana, Engineering Programs Lead
D. Cooper, Operations Manager
H. Cybul, System Engineer Supervisor
J. Gosnell, System Engineer
A. Haeger, Regulatory Assurance Supervisor
G. Kinsella, Fire Marshall
R. Kerr, Engineering and Construction Manager
T. Kirman, Electrical Maintenance Staff Supervisor
W. Kraus, Root Cause Team
F. Lesage, Site Quality Verification
J. Lewand, Regulatory Assurance
J. Maraida, SEC Engineer
J. Meister, Engineering Manager
D. Miller, Technical Services Superintendent
H. Pontious, Nuclear Licensing Administrator
D. Pierce, Conf. Man. Supervisor
K. Radke, Fire Protection System Engineer
M. Togliette, Regulatory Assurance
T. Tulon, Station Manager

U.S. Nuclear Regulatory Commission

D. Chyu, Reactor Engineer
R. Gardner, Engineering Branch Chief
C. Phillips, Senior Resident Inspector
D. Schrum, Reactor Engineer

INSPECTION PROCEDURES USED

IP 64704: Fire Protection Program
IP 37550: Engineering
IP 37551: Onsite Engineering
IP 40500: Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 92902: Followup - Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-456/457/96016-01	URI	Licensee interpretation of singular hot short during a control room fire.
50-456/457/96016-02	URI	Design basis and capacity of RCP oil collection system.
50-456/457/96016-03	EI	Lack of cable separation in certain fire zones.
50-456/457/96016-04	EI	Inoperable roll-up doors as 3-hour rated fire barriers.
50-456/457/96016-05	VIO	Failure to properly filled out Hot Work Permits
50-456/457/96016-06	URI	Ability of personnel to close fire doors during a HELB condition in the turbine building.

Closed

50-456/457/93022-01B	VIO	Failure to identify and take corrective actions for a high failure rate of emergency lights
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Discussed

50-456/457/93022-01A	VIO	Untimely corrective actions for an impaired fire door between the auxiliary and turbine buildings
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LIST OF ACRONYMS USED

AEER	Auxiliary Electric Equipment Room
AF	Auxiliary Feedwater
BwAP	Braidwood Administrative Procedure
BwMS	Braidwood Maintenance Surveillance
CFR	Code of Federal Regulations
DRP	Division of Reactor Projects
DRS	Division of Reactor Safety
CST	Central Standard Time
DG	Diesel Generator
EA	Enforcement Action
EI	Escalated Enforcement Item
EDG	Emergency Diesel Generator
ESF	Engineered Safety Function
FHAR	Fire Hazards Analysis Report
FHP	Fire Hazards Panel

LIST OF ACRONYMS USED (cont'd)

FMR	Field Monitoring Report
FPR	Fire Protection Report
GL	Generic Letter
HELB	High Energy Line Break
IN	Information Notice
LER	Licensing Event Report
MCC	Motor Control Center
MCR	Main Control Room
MEER	Miscellaneous Electrical Equipment Room
MOV	Motor-Operated Valves
PDR	Public Document Room
NEI	Nuclear Energy Institute
PIF	Problem Investigation Form
PORVs	Power Operated Relief Valve
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NUREGs	Nuclear Regulations
RHR	Reactor Heat Removal
SER	Safety Evaluation Report
SSA	Safety System Actuation
SSER	Safety Evaluation Report
SL	Sargent & Lundy
SX	Essential Service Water
URI	Unresolved Item