January 8, 2001

Mr. Oliver D. Kingsley
President, Nuclear Generation Group
Commonwealth Edison Company
ATTN: Regulatory Services
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: BRAIDWOOD - NRC INSPECTION REPORT 50-456/00-06(DRS); 50-457/00-06(DRS)

Dear Mr. Kingsley:

On June 16, 2000, the NRC completed a fire protection triennial baseline inspection of your Braidwood Station. The enclosed report presents the results of that inspection which were discussed on August 18, 2000, with Mr. T. Tulon, Site Vice President, and other members of your staff. In addition, the NRC discussed the inspection results with Mr. D. Helwig, Senior Vice President, Nuclear Services, and members of your staff in a public exit meeting on October 5, 2000, at the NRC's Region III offices in Lisle, Illinois. Information provided to the NRC subsequent to the public exit meeting resulted in a telephone re-exit on November 30, 2000.

The inspection examined the effectiveness of activities conducted under your license as they related to implementation of your NRC approved Fire Protection Program. The inspectors reviewed selected design drawings, calculations, analyses, procedures and audits, performed field walkdowns and interviewed personnel.

Based on the results of this inspection, two issues of very low safety significance (No color) were identified. The two issues were considered violations of the Braidwood Station's Facility Operating License. However, the violations were non-cited due to the very low safety significance of the issues and because they have been entered into your corrective action program. The violations are being treated as Non-Cited Violations (NCVs), consistent with Section VI.A of the Enforcement Policy. The NCVs are described in the subject inspection report. If you contest the violations or severity level of the NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001, with copies to the Regional Administrator, U.S. Nuclear Regulatory Commission, Region III, 801 Warrenville Road, Lisle, Illinois 60532-1396, the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Braidwood Station.

In addition, the inspectors identified five issues that were designated as unresolved items (URIs). These issues are discussed in the enclosed report. Several of these issues require additional information to support your position that the issues do not represent violations of the Braidwood Station's licensing basis. Specific issues requiring additional response are

identified in Attachment 1 of the enclosed report. Please provide a written response to the issues identified in Attachment 1 within 30 days of receipt of this letter.

In accordance with 10 CFR Part 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

/RA Roy J. Caniano Acting for/

John A. Grobe, Director
Division of Reactor Safety

Docket Nos. 50-456; 50-457
License Nos. NPF-72; NPF-77

Enclosure: Inspection Report 50-456/00-06(DRS);
50-457/00-06(DRS)

cc w/encl: D. Helwig, Senior Vice President, Nuclear Services
C. Crane, Senior Vice President, Nuclear Operations
H. Stanley, Vice President, Nuclear Operations
R. Krich, Vice President, Regulatory Services
DCD - Licensing
T. Tulon, Site Vice President
K. Schwartz, Station Manager
T. Simpkin, Regulatory Assurance Supervisor
M. Aguilar, Assistant Attorney General
State Liaison Officer
Chairman, Illinois Commerce Commission

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REGION III

Docket Nos:	50-456; 50-457
License Nos:	NPF-72; NPF-77
Report No:	50-456/00-06(DRS); 50-457/00-06(DRS)
Licensee:	Commonwealth Edison Company
Facility:	Braidwood Station, Units 1 and 2
Location:	35100 S. Route 53 Suite 84 Braceville, IL 60407-9617
Dates:	June 5 - June 16, 2000
Team Leader:	G. Hausman, Senior Reactor Inspector Electrical Engineering Branch
Inspectors:	D. Chyu, Reactor Inspector Electrical Engineering Branch
	P. Qualls, Fire Protection Engineer Plant Systems Branch Office of Nuclear Reactor Regulation
	R. Deem, Contractor Brookhaven National Laboratory
	K. Sullivan, Contractor Brookhaven National Laboratory
Approved By:	Ronald N. Gardner, Chief Electrical Engineering Branch Division of Reactor Safety

NRC's REVISED REACTOR OVERSIGHT PROCESS

The federal Nuclear Regulatory Commission (NRC) recently revamped its inspection, assessment, and enforcement programs for commercial nuclear power plants. The new process takes into account improvements in the performance of the nuclear industry over the past 25 years and improved approaches of inspecting and assessing safety performance at NRC licensed plants.

The new process monitors licensee performance in three broad areas (called strategic performance areas) reactor safety (avoiding accidents and reducing the consequences of accidents if they occur), radiation safety (protecting plant employees and the public during routine operations), and safeguards (protecting the plant against sabotage or other security threats). The process focuses on licensee performance within each of seven cornerstones of safety in the three areas:

Reactor Safety	Radiation Safety	Safeguards
● Initiating Events	● Occupational	● Physical Protection
● Mitigating Systems	● Public	
● Barrier Integrity		
● Emergency Preparedness		

To monitor these seven cornerstones of safety, the NRC uses two processes that generate information about the safety significance of plant operations: inspections and performance indicators. Inspection findings will be evaluated according to their potential significance for safety, using the Significance Determination Process, and assigned colors of GREEN, WHITE, YELLOW or RED. GREEN findings are indicative of issues that, while they may not be desirable, represent very low safety significance. WHITE findings indicate issues that are of low to moderate safety significance. YELLOW findings are issues that are of substantial safety significance. RED findings represent issues that are of high safety significance with a significant reduction in safety margin.

Performance indicator data will be compared to established criteria for measuring licensee performance in terms of potential safety. Based on prescribed thresholds, the indicators will be classified by color representing varying levels of performance and incremental degradation in safety: GREEN, WHITE, YELLOW, and RED. GREEN indicators represent performance at a level requiring no additional NRC oversight beyond the baseline inspections. WHITE corresponds to performance that may result in increased NRC oversight. YELLOW represents performance that minimally reduces safety margin and requires even more NRC oversight. And RED indicates performance that represents a significant reduction in safety margin but still provides adequate protection to public health and safety.

The assessment process integrates performance indicators and inspection so the agency can reach objective conclusions regarding overall plant performance. The agency will use an Action Matrix to determine in a systematic, predictable manner which regulatory actions should be taken based on a licensee's performance. The NRC's actions in response to the significance (as represented by the color) of issues will be the same for performance indicators as for inspection findings. As a licensee's safety performance degrades, the NRC will take more and increasingly significant action, which can include shutting down a plant, as described in the Action Matrix.

More information can be found at: http://www.nrc.gov/NRR/OVERSIGHT/index.html.

SUMMARY OF FINDINGS

IR 05000456-00-06(DRS); IR 05000457-00-06(DRS), on 06/05 - 06/16/2000, Commonwealth Edison Company, Braidwood Nuclear Power Station, Units 1 & 2. Fire protection baseline inspection.

The inspection was conducted by region based inspectors, a Headquarters specialist, and two NRC contractors. The inspection identified two no color findings which were Non-Cited Violations (NCVs). The significance of findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process (SDP)." Findings for which the SDP does not apply are indicated by (No Color).

Inspector Identified Findings

Cornerstone: Initiating Events and Mitigating Systems

No Color. The licensee did not provide any objective evidence that the molded case circuit breakers at the 120Vac and 125Vdc voltage levels had been periodically manually exercised, inspected, and tested as required by the Braidwood Station's Fire Protection Report (FPR), Chapter 2.4, "Safe Shutdown Analysis," Section 2.4.1.5, "Assumptions," paragraph 5.a. The license's failure to periodically manually exercise, inspect, and test molded case circuit breakers to ensure proper operation as assumed by the FPR is a violation of the Braidwood Station's Facility Operating License (Section 1R05.5b.(1)).

No Color. The guidelines established by Branch Technical Position (BTP) Chemical Engineering Branch (CMEB) 9.5-1, Section C.5.c, "Alternative or Dedicated Shutdown Capability," paragraph (2)(d), required that the process monitoring function should be capable of providing direct readings of the process variables necessary to perform and control the shutdown functions. Analyzed instrumentation for the reactor coolant pump (RCP) seal leak-off temperature indication was not available to the operators outside of the main control room. This temperature indication was necessary for the operators to determine when to trip the RCPs prior to reaching RCP seal temperature limitations. The license's failure to provide an analysis that demonstrated the capability of plant operators involved in post-fire shutdown activities to have access to the seal leak-off temperature process variable, necessary to perform and control the reactor coolant makeup function, is a violation of the Braidwood Station's Facility Operating License (Section 1R05.5b.(2)).

Report Details

Summary of Plant Status: During the on-site inspection period, Braidwood Station's Units 1 and 2 operated at or near full power.

1. REACTOR SAFETY

Cornerstones: Initiating Events and Mitigating Systems

1R05 Fire Protection

The purpose of this inspection was to review the Braidwood Station's Fire Protection Program (FPP) for selected risk significant areas. Emphasis was placed on verification that the post-fire safe shutdown capability and the fire protection features provided for ensuring that at least one post-fire safe shutdown success path was maintained free of fire damage. The inspection was performed in accordance with the Nuclear Regulatory Commission's (NRC's) new regulatory oversight process using a risk-informed approach for selecting the risk significant areas and attributes to be inspected. The inspection team and an NRC Office of Nuclear Reactor Regulation (NRR) senior reactor analyst used the Braidwood Station's Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities to choose several risk significant areas for detailed inspection and review. The areas chosen for review during this inspection were:

- Fire Zone 5.5-1, Unit 1 Auxiliary Electrical Equipment Room (AEER),
- Fire Zone 11.5-0, Unit 1 Auxiliary Building General Area, 401' Elevation,
- Fire Zone 11.6-0, Unit 1 Auxiliary Building General Area, 426' Elevation, and
- Fire Zone 2.1-0, Main Control Room (MCR).

For each of these fire zones, the inspectors focused their inspection effort on the fire protection features, the systems and equipment necessary for the licensee to achieve and maintain safe shutdown conditions, determination of licensee commitments, and changes to the FPP.

Fire Protection Program License Requirements

The Braidwood Station's Facility Operating Licenses, NPF-72 and NPF-77 (Unit 1 and Unit 2, respectively), Section 2.E stated:

> The licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report, as supplemented and amended, and as approved in the Safety Evaluation Report dated November 1983 and its supplements, subject to the following provision.

> The licensee may make changes to the approved fire protection program without prior approval of the Commission, only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

The Braidwood Station's Updated Final Safety Analysis Report (UFSAR), Chapter 9.0, "Auxiliary Systems," Section 9.5.1, "Fire Protection Systems," stated:

> The design bases, system descriptions, safety evaluation, inspection and testing requirements, personnel qualification, and training are described in Reference 1 ["Byron/Braidwood Stations Fire Protection Report [FPR] in Response to Appendix A of BTP [Branch Technical Position] APCSB [Auxiliary Power Conversion Systems Branch] 9.5-1," current amendment [18]. Also known as the FPR.

The Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," provided the licensee's statements of implementation or justification for noncompliance with the guidelines established by BTP Chemical Engineering Branch (CMEB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," Revision 2 dated July 1981, contained in NUREG 0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 9.5-1, "Fire Protection Program," Revision 3 dated July 1981, which was analogous to Title 10, Code of Federal Regulations (CFR) Part 50, Appendix R.

.1 Systems Required to Achieve and Maintain Post-Fire Safe Shutdown

The guidelines established by BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraph (1), required the licensee to provide fire protection features that were capable of limiting fire damage to structures, systems, and components (SSCs) important to safe shutdown. The SSCs that were necessary to achieve and maintain post-fire safe shutdown were required to be protected by fire protection features that were capable of limiting fire damage to the SSCs so that:

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

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

Specific design features for ensuring this capability were provided in BTP CMEB 9.5-1, Section C.5.b, paragraph (2).

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirements.

In the Braidwood Station's FPR, Chapter 2.4, "Safe Shutdown Analysis [SSA]," Section 2.4.1.1, "Purpose," the licensee stated that for the purpose of SSA, hot standby, cold shutdown and safe shutdown were defined as follows:

- Hot Standby - A plant condition in which the reactor is sub-critical with a shutdown margin per the Technical Specifications, and the primary coolant system average temperature is greater than or equal to 350°F.

- Cold Shutdown - A plant condition in which the reactor is sub-critical with a shutdown margin per the Technical Specifications, and the primary coolant system average temperature is less than or equal to 200°F.

- Safe Shutdown - A plant condition achieved by satisfying the following requirements

  a. maintain a condition of negative reactivity,
  b. monitor and control the primary system coolant inventory and pressure, and
  c. remove decay heat.

In the FPR, Chapter 2.4, "Safe Shutdown Analysis," Section 2.4.1.4, "Safe Shutdown Equipment," paragraphs a and b, the licensee identified the performance goals for the shutdown functions necessary to achieve and maintain post-fire safe shutdown (hot standby and cold shutdown) conditions. The performance goals were stated as "... the safe shutdown functions of reactivity control, primary coolant system inventory and pressure control and decay heat removal." The systems which may be used by the operators to perform the safe shutdown functions were identified in the SSA's Table 2.4-1, "Systems Required to Perform Safe Shutdown Functions." The licensee also identified the SSCs that were required to achieve and maintain post-fire safe shutdown conditions in the event of a fire in the SSA's Table 2.4-2, "Safe Shutdown Equipment List [SSEL]," which included the SSCs' support systems.

a. Inspection Scope

The inspectors reviewed the licensee's performance goals necessary for achieving and maintaining post-fire safe shutdown conditions to determine whether the licensee's post-fire safe shutdown methodology properly identified the SSCs necessary to achieve and maintain post-fire safe shutdown conditions. The inspectors focused on the following performance goals to ensure that at least one post-fire safe shutdown success path was available in the event of a fire in each of the selected fire zones:

- Reactivity Control - capable of achieving and maintaining cold shutdown reactivity conditions

- Reactor Coolant Makeup - capable of maintaining the reactor coolant level within the level indication in the pressurizer

- Reactor Heat Removal - capable of achieving and maintaining decay heat removal

- Process Monitoring - capable of providing direct readings of the process variables for accomplishing reactivity control, reactor coolant makeup, and reactor heat removal; and

- Support Functions - capable of providing all other services necessary to permit extended operation of equipment necessary to achieving and maintaining post-fire safe shutdown (hot standby and cold shutdown) conditions

The inspectors reviewed the licensee's SSEL to determine whether the components necessary for safe shutdown systems to accomplish their required shutdown functions were included in the SSEL. In addition, the inspectors reviewed the safe shutdown systems' piping and instrumentation diagrams (P&IDs) to identify the components necessary for successful system operation, which included components that could cause flow diversion or system isolation, and valves which interfaced with the primary reactor coolant system (RCS) boundary whose mal-operation could result in a loss-of-coolant accident (LOCA). The inspectors' review also included the Braidwood Station's safe shutdown procedures 1Bw0A PRI-5, "Control Room Inaccessibility Unit 1," Revision 57C and 2Bw0A PR I-5, "Control Room Inaccessibility Unit 2," Revision 57D.

b. Findings

Equipment Important for Safe Shutdown Not Identified

During this inspection, the inspectors' review of the Braidwood Station's P&IDs and the FPR's, Chapter 2.4, "Safe Shutdown Analysis," Table 2.4-2, "Safe Shutdown Equipment List," resulted in the identification of components that were not included in the SSA or SSEL, whose spurious operation could degrade safe shutdown of the plant. Examples identified by the inspectors included the centrifugal charging pump discharge valve, pressurizer auxiliary spray valve, component cooling water (CCW) thermal barrier cooling isolation valves and the main steam isolation valves (MSIVs).

Charging Pump Discharge Valve

The inspectors' review of the SSEL determined that the only components identified by the licensee as being required to support the operation of the charging system were the redundant centrifugal charging pumps, the charging pumps' lube oil and gear coolers, and the four valves located in the suction path from the volume control tank (1CV112B and 1CV112C) and reactor water storage tank (1CV112D and 1CV112E). In general, motor-operated valves (MOVs) or solenoid-operated valves located in the required flow path were not included in the licensee's list of equipment required to achieve post-fire safe shutdown. In accordance with the licensee's SSA philosophy, automatic actuated flow-path valves (i.e., air-operated valves (AOVs) or MOVs) that were in their desired post-fire safe shutdown position during normal plant operations were not included in the SSEL. Specific examples included the charging pump discharge valve 1FCV121, a normally open AOV whose inadvertent closure due to fire-induced circuit faults could result in a loss of all reactor coolant makeup and reactor coolant pump (RCP) seal injection flow until manual operator recovery actions were completed and 1CV8355A, B, C, and D, which were normally open MOVs located in the seal injection flow path to each RCP.

Pressurizer Auxiliary Spray Valve

The normal charging line to the RCS was not credited for post-fire safe shutdown by the licensee. This flow path branched off the credited RCP seal injection flow path and consisted of a series of four normally open valves (1CV182, 1CV8106, 1CV8105 and 1CV8324A) before entering the regenerative heat exchanger. The pressurizer auxiliary spray valve (1CV8145) was a normally closed MOV located downstream of the regenerative heat exchanger. None of the valves in this flow path, including 1CV8145, were included in the SSEL and none of the cables associated with these valves were evaluated for the effects of fire damage. The spurious opening of 1CV8145 due to fire-induced faults in its control circuitry, coupled with the failure to isolate the normal charging path, would cause a collapse of the steam bubble in the pressurizer and rapid depressurization of the RCS. This issue was previously identified by the licensee as part of its May 15, 2000, self-assessment. However, the licensee stated in their self-assessment report that it considered the potential for spurious operation of 1CV8145 to be the result of two independent spurious operations (i.e., opening of the pressurizer auxiliary spray valve and the failure to isolate normal letdown). Additionally, in the licensee's response to the inspectors' request for a technical basis for its determination that fire damage to the cables associated with this valve would not have an adverse impact on safe shutdown capability, the licensee stated: "Since the normal charging flowpath is assumed to be unavailable and not in use, the pressurizer auxiliary spray valve is of no consequence to the safe shutdown analysis." The inspectors did not concur with this conclusion since all of the valves in this flow path up to the pressurizer auxiliary spray valve (1CV8145) were open and a single spurious actuation of the valve (1CV8145) would initiate this event. Additionally, the normal charging path was not isolated during implementation of the safe shutdown procedure.

CCW Thermal Barrier Isolation Valves

The spurious operation of the CCW thermal barrier cooling isolation valves (1CC9413A, 1CC9413B, and 1CC9415) was not evaluated in the SSA. If any one of the valves were to spuriously close, thermal barrier cooling to the RCP seals would be isolated to all four RCPs. This would result in a loss of redundancy in RCP seal cooling capability, and possible seal failure, if there was a concurrent loss of charging flow through the RCP seals.

Main Steam Isolation Valves

The licensee was questioned why the MSIVs were not on the SSEL and why spurious operation of one or more MSIVs (1MS001A,B,C, and D) were not evaluated in the SSA. The licensee was also asked about inadvertent or uncontrolled blowdown of the steam generators and potential overcooling of the RCS. The licensee stated that the MSIVs were only closed (manually or automatically) on low steam pressure or on indication of a steam generator tube failure. To determine how the RCS would respond to this type of transient, the inspectors reviewed the design basis accident analysis in the licensee's UFSAR, Chapter 15, "Accident Analyses." Review of the UFSAR analysis showed that overcooling of the RCS would result in the pressurizer level dropping below instrument indication range within 63 seconds without immediate main feedwater isolation.

Additionally, if fire were to damage circuitry which automatically tripped the turbine and main feedwater pumps, overcooling was a concern.

Title 10 CFR Part 50.48(a), "Fire Protection," stated in part, that the fire protection plan must describe the means to limit fire damage to SSCs important to safety so that the capability to safely shutdown the plant is ensured. Not including these components on the SSEL demonstrated a lack of completeness in the licensee's fire protection plan for determining the components required to support safe shutdown. The inspectors concluded that the licensee's FPR failed to fully describe the means to limit fire damage to SSCs important to safety, such as the charging pump discharge valve, pressurizer auxiliary spray valve, CCW thermal barrier cooling isolation valves, and MSIVs. In addition, since the licensee's list of cables identified for each hazard zone was developed from the SSEL, the routing of cables associated with components not included in the SSEL was not identified in its "Safe Shutdown Equipment and Cables by Hazard Zone" (SSA, Table 2.4-4). Therefore, it did not appear that the effects of fire damage to cables and circuits associated with these components had been adequately evaluated for each fire zone.

The inspectors concluded that the identified issues concerning potential effects of fire damage on associated circuits related to safe shutdown components and the resultant spurious actuation of such components was an unresolved item (URI) pending completion of the NRC/industry review and resolution of issues affecting safe shutdown associated circuits. (URI 50-456/00-06-01(DRS); 50-457/00-06-01(DRS))

.2 Fire Protection of Safe Shutdown Capability

The guidelines established by BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraphs (2).(a) and (3), required:

> Separation of cables and equipment and associated circuits of redundant trains by a fire barrier having a 3-hour rating and if the guidelines of Position C.5.b.(1) and C.5.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.

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirements.

In the Braidwood Station's FPR, Appendix A5.7, "Appendix R–Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," Section III.G, "Fire Protection of Safe Shutdown Capability," paragraph 3.b, the licensee stated that a fire detection and a fixed fire suppression system shall be installed in the area under consideration requiring alternative or dedicated shutdown capability.

a. Inspection Scope

For each of the fire areas selected, the inspectors reviewed the licensee's SSA to ensure that at least one post-fire safe shutdown success path was available in the event of a fire. This included a review of manual actions required to achieve and maintain hot

shutdown conditions and to make the necessary repairs to reach cold shut down within 72 hours. The inspectors also reviewed selected procedures to ensure that adequate direction was provided to the operators to perform the necessary manual actions. Factors, such as timing, access to the equipment, and the availability of procedures, were considered in the inspectors' review.

The inspectors also evaluated the adequacy of fire suppression and detection systems, fire area barriers, penetration seals, and fire doors to ensure that at least one train of safe shutdown equipment was free of fire damage. To do this, the inspectors observed the material condition and configuration of the installed fire detection and suppression systems, fire barriers, and construction details and supporting fire tests for the installed fire barriers. In addition, the inspectors reviewed license documentation, such as deviations, detector placement drawings, fire hose stations drawings, carbon dioxide pre-operational test reports, smoke removal plans, fire hazard analysis reports, SSA, and National Fire Protection Association (NFPA) codes to verify that the fire barrier installations met license commitments.

b. Findings

License Requirements Reduced for Two Auxiliary Building Fire Zones

During this inspection, the inspectors determined that the licensee changed Fire Zones 11.5-0 and 11.6-0 (Auxiliary Building, 401' and 426' elevations, respectively), from fire zones which complied with the guidelines of BTP CMEB 9.5-1, Section C.5.b.(2).(a), which required separating redundant safe shutdown trains with a 3-hour fire barrier, to areas for which alternative shutdown capability should be provided in accordance with BTP CMEB 9.5-1, Section C.5.b.(3).

The two fire zones had been originally accepted by the NRC based on their meeting NUREG 0800, Standard Review Plan, Section 9.5.1 guidance. The original approval was based on separation of redundant trains of equipment required to achieve safe shutdown conditions with a 3-hour rated fire barrier.

To resolve concerns for Thermo-Lag 330, the licensee rerouted redundant cables from the area except the cables for the MCR ventilation system. The redundant cables for the MCR ventilation system were needed for safe shutdown and were not protected by a 3-hour rated fire barrier. Therefore, the licensee designated the fire zones as areas that utilize alternative shutdown capability. However, the licensee did not install a fixed fire suppression system in the fire zones as required by the Braidwood Station's FPR, Appendix A5.7, "Appendix R–Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," Section III.G, "Fire Protection of Safe Shutdown Capability," paragraph 3.b, where the licensee stated that a fire detection and a fixed fire suppression system shall be installed in the area under consideration requiring alternative or dedicated shutdown capability.

The Braidwood Station's Facility Operating License allowed the licensee to make changes to the approved fire protection plan provided the changes did not adversely affect the ability to achieve safe shutdown conditions. The inspectors considered that the change for Fire Zones 11.5-0 and 11.6-0 adversely affected the ability to achieve

safe shutdown in that the licensee went from full compliance with the separation criteria to less than full compliance with the alternative shutdown criteria.

The inspectors concluded that the licensee's actions to re-classify Fire Zones 11.5-0 and 11.6-0 as alternative shutdown areas without prior NRC review and approval appeared to be a violation of the Braidwood Station's Facility Operating License. However, the licensee stated that the re-classification of the fire zones was made in a manner that was consistent with Generic Letter (GL) 86-10 and the standard license condition under 10 CFR Part 50.59. The inspectors considered this issue to be an unresolved item (URI) pending review of additional information to be provided by the licensee as identified in Attachment 1 of this report. (URI 50-456/00-06-02(DRS); 50-457/00-06-02(DRS))

.3 Post-Fire Safe Shutdown Circuit Analysis

The guidelines established by BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraph (1), required that SSCs important to safe shutdown be provided with fire protection features capable of limiting fire damage to ensure that one train of systems necessary to achieve and maintain hot shutdown conditions remained free of fire damage. Options for providing this level of fire protection were delineated in BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraph (2).

Where the protection of systems whose function was required for hot shutdown did not satisfy BTP CMEB 9.5-1, Section C.5.b, paragraph (2), an alternative or dedicated shutdown capability and its associated circuits, was required to be provided that was independent of the cables, systems and components in the area. For such areas, BTP CMEB 9.5-1, Section C.5.c, "Alternative or Dedicated Shutdown Capability," paragraph (3), specifically required the alternative or dedicated shutdown capability to be physically and electrically independent of the specific fire areas and capable of accommodating post-fire conditions where offsite power was available and where offsite power was not available for 72 hours.

Additionally, BTP CMEB 9.5-1, Section C.5.c, "Alternative or Dedicated Shutdown Capability," paragraph (7), required, in part, that (a) the safe shutdown equipment and systems for each fire area to be known to be isolated from associated circuits in the fire area so that fire damage (i.e., hot shorts, open circuits, and shorts to ground) to the associated circuits would not prevent the operation of safe shutdown equipment, and (b) associated circuits of redundant divisions of shutdown equipment be separated, protected, or isolated from shutdown equipment so that a postulated fire involving associated circuits would not prevent safe shutdown.

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirements.

a. Inspection Scope

The inspectors performed a review of the licensee's SSA and SSEL to determine whether the licensee had appropriately identified and analyzed the safety-related and nonsafety-related cables associated with safe shutdown equipment located in the selected plant fire zones. The inspectors' review included the assessment of the

licensee's electrical systems and electrical circuit analyses with respect to the requirements identified below to show that these cables would not prevent safe shutdown because of hot shorts, open circuits, or shorts to ground.

In GL 81-12, “Fire Protection Rule,” dated February 20, 1981, and its subsequent clarification, dated March 22, 1982, the NRC provided the principal staff guidance regarding potential configurations of associated circuits of concern to post-fire safe shutdown capability. In addition, the staff, through the issuance of additional GLs and Information Notices (INs) presented other opportunities for licensees to recognize the potential impact that fire damage to associated circuits may have on the implementation of post-fire safe shutdown capability. Specifically, additional guidance related to this issue has been disseminated in IN 84-09, IN 85-09, IN 92-18, and GL 86-10. As described in these documents, associated circuits of concern to post-fire safe shutdown were non-essential circuits and cables whose damage due to fire could adversely affect the shutdown capability. Specific configurations of these circuits and cables included:

- Circuits which share a common power supply (e.g., switchgear, motor control center (MCC), fuse panel) with circuits of equipment required to achieve and maintain safe shutdown; or,

- Circuits which share a common enclosure, (e.g., raceway, conduit, junction box, etc.) with cables of equipment required to achieve and maintain safe shutdown; or,

- Circuits of equipment whose spurious operation or mal-operation may adversely affect the successful accomplishment of safe shutdown functions.

b. Findings

The Effects of Associated Circuits Not Isolated from Alternative Shutdown Capability

The Unit 1 AEER, located in the Auxiliary Building at Elevation 451', was identified as Fire Zone 5.5-1. The licensee designated Fire Zone 5.5-1 as an alternative shutdown area since it did not meet the separation or protection requirements of BTP CMEB 9.5-1, Section C.5.b., “Safe Shutdown Capability,” paragraph (2).

In the Braidwood Station’s FPR, the licensee stated that they complied with the guidelines of BTP CMEB 9.5-1, Section C.5.c., “Alternative or Dedicated Shutdown Capability,” paragraph (7). The guideline required that 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 would not prevent operation of the safe shutdown equipment. In addition, the isolation of these associated circuits from the safe shutdown equipment should be such that a postulated fire involving associated circuits would not prevent safe shutdown. The licensee further stated in the FPR, Chapter 2.4, “Safe Shutdown Analysis,” Section 2.4.1.5, “Assumptions,” paragraph 5, that the concern of spurious actuation by an associated circuit, whose fire-induced failure could affect shutdown, did not exist in the current Braidwood Station design.

The solid state protection system (SSPS) cabinets were located in Fire Zone 5.5-1. Fire damage to the SSPS could produce a Containment Phase B (CISB) actuation signal. Initiation of the CISB actuation signal would isolate CCW cooling to the RCPs' thermal barrier. Although the SSPS required two out of four containment pressure input signals to be present to satisfy the containment isolation logic, it appeared that one fire-induced ground fault at the master/slave relay logic output cabinet of the SSPS would be sufficient to initiate the automatic actuation signal from the SSPS.

The CISB actuation and a subsequent loss of suction sources to the centrifugal charging pumps (CCPs) would result in RCP seal failure resulting in a small LOCA as discussed in Section 1R05.4b.(1) of this report. The fire-induced actuation of the SSPS in this case would prevent the licensee from achieving and maintaining safe shutdown conditions for a postulated fire in the Unit 1 AEER. As a result, the inspectors concluded that the effects of fire damage to circuits and cables associated with the SSPS had not been adequately evaluated for each fire zone.

The inspectors concluded that the identified issues concerning potential effects of fire damage on associated circuits related to safe shutdown components in the AEER and the resultant spurious actuation of such components was an unresolved item (URI) pending completion of the NRC/industry review and resolution of issues affecting safe shutdown associated circuits. (URI 50-456/-00-06-03(DRS); 50-457/00-06-03(DRS))

.4 Alternative Shutdown Capability

The guidelines established by BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraph (1) required the licensee to provide fire protection features that were capable of limiting fire damage so that one train of systems necessary to achieve and maintain hot shutdown conditions remained free of fire damage. Specific design features for ensuring this capability were provided in BTP CMEB 9.5-1, Section C.5.b, paragraph (2).

Where compliance with the separation criteria of BTP CMEB 9.5-1, Section C.5.b, paragraphs (1) and (2) could not be met, BTP CMEB 9.5-1, Section C.5.b, paragraph (3) and Section C.5.c, required an alternative or dedicated shutdown capability be provided that was independent of the specific fire area under consideration. Additionally, alternative or dedicated shutdown capability must be able to achieve and maintain hot standby conditions and achieve cold shutdown conditions within 72 hours and maintain cold shutdown conditions thereafter. During the post-fire safe shutdown, the reactor coolant process variables must remain within those predicted for a loss of normal ac power, and the fission product boundary integrity must not be affected (i.e., no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary).

The licensee stated that the Braidwood FPP complied with the following BTP CMEB 9.5-1, Section C.5.c., "Alternative or Dedicated Shutdown Capability," paragraphs:

Paragraph	Requirement
(1)	"During the post-fire shutdown,... the fission product boundary integrity shall not be affected; i.e., there shall be no... rupture of any primary coolant boundary..."
(2)	"The performance goals for the shutdown functions should be ..." reactivity control, reactor coolant makeup, reactor heat removal, process monitoring, and supporting functions.
(3)	"...the alternative shutdown capability shall be independent of the specific fire area(s)."

a. Inspection Scope

To assess the alternative shutdown methodology developed by the licensee, the inspectors performed an evaluation of selected plant fire zones. The inspectors reviewed the licensee's alternative shutdown methodology to determine the identified components and systems necessary to achieve and maintain safe shutdown conditions. This included: (1) verifying that the methodology addressed achieving and maintaining hot and cold shutdown from outside the MCR with off-site power available or not available; and (2) verifying that the transfer of control from the MCR to the alternative location had been demonstrated to not be affected by fire-induced circuit faults. The inspectors also reviewed associated Braidwood Station calculations, administrative procedures (BwAPs), abnormal operating procedures (BwOAs), operating surveillance procedures, engineering surveillance procedures and electrical maintenance surveillance procedures (BwHP) to verify the adequacy of the design and implementation of the alternative shutdown capability.

b. Findings

Background

At the Braidwood Station, reactivity control was partially accomplished by using one of two CCPs to inject borated water into the RCS via the chemical volume control system's (CVCS's) makeup flow path. The source of borated water was initially taken from the volume control tank (VCT), then manually switched to the reactor water storage tank (RWST). With normal letdown isolated, required makeup would be minimized to prevent the pressurizer from going solid. As a result, the only need for makeup was RCS boration and RCP seal cooling. The RCP seals were cooled by CCP seal injection flow, which provided the bulk of the cooling, along with CCW to the RCPs' thermal barrier. The centrifugal charging pumps' (1CV01PA and 1CV01PB) normal flow path configuration (i.e., suction path) was through the series connected VCT outlet valves (1CV112B and 1CV112C), which were maintained open during power operations. The CCPs' alternate flow path configuration was through the parallel connected RWST outlet

valves (1CV112D and 1CV112E), which were maintained closed during normal power operations.

(1) Fire Zone 11.5-0, Auxiliary Building General Area, 401' Elevation

Fire Zone 11.5-0 was originally designated as a fire zone meeting the requirements of BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraph (2), such that one of the redundant trains was free of fire damage by separation of cables and equipment and associated circuits of redundant trains by a fire barrier having a 3-hour rating. Subsequent to the original designation, the licensee identified that the MCR ventilation system cables were routed through the area and did not meet the above separation requirement. As a result, the licensee designated Fire Zone 11.5-0 as an alternative shutdown area. The licensee concluded that the operators could stay in the MCR until the temperature exceeded the equipment limits.

Alternative Shutdown Capability Was Not Independent of Fire Zone 11.5-0

During this inspection, the inspectors determined that the power cable for the 1A CCP and the control cables for the VCT and RWST outlet valves were routed through Fire Zone 11.5-0, and were not protected. Potential fire damage to the control cables for the VCT outlet valves could result in mal-operation (i.e, closure) of either valve and a loss of suction source to the remaining 1B CCP resulting in pump cavitation. The RWST outlet valves were parallel connected and maintained closed during normal power operations. The licensee had identified that these two valves were susceptible to mechanical damage as described in IN 92-18. Fire damage to these cables could result in mal-operation (i.e., closure) of the valves and cause mechanical damage to the valves such that they could not be manually aligned to supply a suction source to the remaining 1B CCP.

In the event of a fire in Fire Zone 11.5-0, fire damage to the control cables for the VCT and RWST outlet valves could result in loss of suction to the CCPs. Loss of suction to the CCPs would result in loss of seal injection flow to the RCP seals and affect the reactivity control and reactor coolant makeup performance goals as identified in BTP CMEB 9.5-1, Section C.5.c.(2).

To assess the significance of this issue, the licensee initiated a review of the cable routings for the VCT and RWST outlet valves. Pending review of the results of the licensee's actions, this issue is an unresolved item (URI). Specific issues requiring additional licensee response are identified in Attachment 1 of this report. (URI 50-456/00-06-04(DRS); 50-457/00-06-04(DRS))

Alternative Shutdown Capability Did Not Ensure Integrity of the Primary Coolant Boundary

During this inspection, the inspectors determined that the control cables for the seal injection flow path valves (1CV8355A, B, C, and D) were routed through Fire Zone 11.5-0 and were not protected. The normally open seal injection flow valves were parallel connected and provided seal injection flow to the RCP seals. The

inspectors also determined that the control cables for the CCW containment isolation supply valves were routed through Fire Zone 11.5-0. Fire damage to the control cables to the seal injection flow and CCW supply valves could result in mal-operation (i.e., closing of the valves). The loss of CCW flow to the RCPs' thermal barrier and the loss of CCP seal injection flow to the RCP seals would result in a total loss of all RCP seal cooling.

The licensee stated that RCP seal integrity could be assured following a total loss of RCP seal cooling provided the RCPs were tripped prior to the RCP seals reaching a temperature limit of 235°F. However, with no analyzed temperature instrumentation available to provide the operators with a method to determine when the seal temperature limit was reached during a post-fire condition outside of the MCR (as would be required if a fire occurred in the Fire Zone 11.5-0), fire damage to the above cables would result in a rupture of the primary coolant boundary similar to a small LOCA.

The licensee's alternative shutdown capability for Fire Zone 11.5-0 did not appear to assure that during the post-fire conditions, the fission product boundary integrity would not be affected since a fire in Fire Zone 11.5-0 could result in a complete loss of RCP seal cooling due to the operators' inability to ensure seal integrity by tripping the RCPs before the seals reached 235°F. In response to this issue, the licensee initiated an analysis to demonstrate adherence to fire protection safe shutdown performance objectives and RCP seal integrity considering the effects of fire induced failures that result in degradation of RCP seal cooling. Pending review of the results of this analysis, this issue is an unresolved item (URI). Specific issues requiring additional licensee response are identified in Attachment 1 of this report. (URI 50-456/00-06-04(DRS); 50-457/00-06-04(DRS))

(2) Fire Zone 11.6-0, Auxiliary Building General Area, 426' Elevation

Fire Zone 11.6-0 was originally designated as a fire zone meeting the requirements of BTP CMEB 9.5-1, Section C.5.b, "Safe Shutdown Capability," paragraph (2), such that one of the redundant trains was free of fire damage by separation of cables and equipment and associated circuits of redundant trains by a fire barrier having a 3-hour rating. Subsequent to the original designation, the licensee identified that the MCR ventilation system cables were routed through the area and did not meet the above separation requirement. As a result, the licensee designated Fire Zone 11.6-0 as an alternative shutdown area. The licensee concluded that the operators could stay in the MCR until the temperature exceeded the equipment limits.

Alternative Shutdown Capability Was Not Independent of Fire Zone 11.6-0

During this inspection, the inspectors determined that the power cable for the 1A CCP and the control cables for the VCT and RWST outlet valves were routed through Fire Zone 11.6-0, and were not protected. Fire damage to the control cables for the VCT outlet valves could result in mal-operation (i.e, closure) of either valve and a loss of suction source to the remaining 1B CCP resulting in

pump cavitation. As stated in Section 1R05.4b, the RWST outlet valves were parallel connected and maintained closed during normal power operations. The licensee had identified that these two valves were susceptible to mechanical damage as described in IN 92-18. Fire damage to these valves' cables could result in mal-operation (i.e., closure) of the valves and cause mechanical damage to the valves such that they could not be manually aligned to supply a suction source to the remaining 1B CCP.

In the event of a fire in Fire Zone 11.6-0, fire damage to the control cables for the VCT and RWST outlet valves could result in loss of suction to the CCPs. Loss of suction to the CCPs would result in loss of seal injection flow to the RCP seals and affect the reactivity control and reactor coolant makeup performance goals as identified in BTP CMEB 9.5-1, Section C.5.c.(2). In addition, the licensee's ability to use the safety injection (SI) pumps for reactor coolant makeup was limited since RCS pressure control and SI pump coolant injection was dependent on the power operated relief valves (PORVs). In the Braidwood Station's FPR, Chapter 2.4, "Safe Shutdown Analysis," Section 2.4.2.50, "Auxiliary Building Elevation 426 feet 0 inch (Fire Zone 11.6-0)," the licensee stated that a control cable for the B PORV and a power cable for the A PORV block valve were routed though the Fire Zone 11.6-0. As a result, fire damage to these cables could cause mal-operation of the valves (i.e., stick open or close).

For the licensee to mitigate the fire-induced actuation of the B PORV and A PORV block valves, safe shutdown procedure, 1Bw0A PRI-5, "Control Room Inaccessibility Unit 1," Revision 57C, directed the operators to close the PORVs and the PORVs' block valves. The PORVs could not be used for depressurization until the licensee effected repair of the cables to achieve cold shutdown. Therefore, the SI pumps would not inject water into the RCS since the RCS pressure was higher than the discharge pressure of the SI pumps.

To assess the significance of this issue, the licensee initiated a review of the cable routings for the VCT and RWST outlet valves. Pending review of the results of the licensee's actions, this issue is an unresolved item (URI). Specific issues requiring additional licensee response are identified in Attachment 1 of this report. (URI 50-456/00-06-05(DRS); 50-457/00-06-05(DRS))

.5 Operational Implementation of Alternative Shutdown Capability

The guidelines established by BTP CMEB 9.5-1, Section C.5.c, "Alternative or Dedicated Shutdown Capability," paragraph (2).(d), required that the process monitoring function should be capable of providing direct readings of the process variables necessary to perform and control the above functions [see the performance goals identified in Section 1R05.1a].

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirement.

In the FPR, Chapter 2.4, "Safe Shutdown Analysis," Section 2.4.1.5, "Assumptions," paragraph 5.a, the licensee stated that the molded case circuit breakers will be

periodically manually exercised and inspected to ensure ease of operation. In addition, a sample of these breakers will be periodically tested to determined that breaker drift is within the allowed according to the design criteria, and all the tests will be performed in accordance with an accepted testing methodology.

a. Inspection Scope

The inspectors performed a review of the licensee's operating procedures for alternative safe shutdown areas (1Bw0A PRI-5, Revision 57C). The review focused on ensuring that all required functions for post-fire safe shutdown and the corresponding equipment necessary to perform those functions were included in the procedures. The review also looked at operator procedural training, as well as consistency between the operations shutdown procedures and any associated administrative controls.

b. Findings

(1) Inadequate Testing for Safe Shutdown Equipment

Molded Case Circuit Breakers Not Periodically Inspected and Tested

During the inspection, the licensee could not provide any objective evidence (e.g., procedures) that the molded case circuit breakers at the 120Vac and 125Vdc voltage levels had been periodically manually exercised, inspected, and tested. Periodic maintenance and testing of molded case circuit breakers is necessary to ensure ease of operation and to assure that set-point drift remains within that allowed by the circuit breaker coordination design calculations. Failure to periodically manually exercise, inspect, and test molded case circuit breakers to ensure proper operation, as assumed by the FPR, is a violation of the Braidwood Station's Facility Operating License. However, because the licensee entered the issue into its corrective action program, this issue will not be cited in accordance with Section VI.A.1 of the NRC Enforcement Policy.
(NCV 50-456/00-06-06(DRS); 50-457/00-06-06(DRS))

(2) Post-Fire Safe Shutdown Procedures

Instrumentation Not Available for Determining RCP Seal Temperature

As discussed in Section 1R05.4b.(1) of this report, due to the potential loss of RCP seal cooling and CCW flow to the thermal barriers, the licensee stated that the RCP seals could withstand a complete loss of seal cooling if the RCPs were tripped prior to seal temperature reaching 235°F. However, analyzed instrumentation for the RCP seal leak-off temperature indication was not available to the operators outside of the MCR. This temperature indication was not on the remote shutdown panel (RSP) or the fire hazard panel and was necessary for the plant operators to determine when to trip the RCPs. If the RCPs were not secured prior to reaching the temperature limit, the seals could fail resulting in a small LOCA and adversely impact reactor coolant makeup capability. The licensee's failure to provide an analysis that demonstrated the capability of plant operators involved in post-fire shutdown activities to have access to the seal leak-

off temperature process variable, necessary to perform and control the reactor coolant makeup function, is a violation of the Braidwood Station's Facility Operating License. Because the licensee entered the issue into its corrective action program, this issue will not be cited in accordance with Section VI.A.1 of the NRC Enforcement Policy. (NCV 50-456/00-06-07(DRS); 50-457/00-06-07(DRS))

.6 Communications

For a fire in an alternative shutdown fire area, MCR evacuation is required and a dual unit shutdown is performed from outside the MCR. Radio communications are relied upon to coordinate the shutdown of both units and for fire fighting and security operations.

The guidelines established by BTP CMEB 9.5-1, Section C.5.g, "Lighting and Communication," paragraph (4), required that a portable 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.

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirement.

a. Inspection Scope

The inspectors reviewed the adequacy of the radio communication system the fire brigade and other operations personnel would use to implement the post-fire safe shutdown methodology. The inspectors also reviewed the licensee's fire protection features that would protect the radio repeaters or any of its associated circuits from fire damage and verified that sufficient channels were available to support safe shutdown implementation.

b. Findings

No findings of significance were identified.

.7 Emergency Lighting

The guidelines established by BTP CMEB 9.5-1, Section C.5.g, "Lighting and Communication," paragraph (1), required that fixed self-contained lighting consisting of fluorescent 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 egress routed to and from all fire areas.

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirement.

a. Inspection Scope

The inspectors performed a walk-down of the alternative shutdown fire areas and the access/egress routes to verify that adequate emergency lighting existed.

b. Findings

No findings of significance were identified.

.8 Cold Shutdown Repairs

The guidelines established by BTP CMEB 9.5-1, Section C.5.c, “Alternative or Dedicated Shutdown Capability,” paragraph (5), required that 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 hours. Materials for such repairs shall be readily available onsite and procedures shall be in effect to implement such repairs.

The licensee stated in the Braidwood Station’s FPR, Chapter 3, “Guidelines of BTP 9.5-1,” that the Braidwood Station’s FPP complied with the above requirement.

a. Inspection Scope

The inspectors examined the licensee’s ability to conduct cold shutdown repairs in accordance with the 72 hour requirement. The inspectors reviewed BwHP 4200-033, "Temporary Restoration Of Safe Shutdown Components," Revision 2, the licensee’s procedure for implementation of cold shutdown repairs. The inspectors assessed whether the licensee identified all the appropriate tools and equipment needed to complete the required cold shutdown repairs. The inspectors verified whether the tools and equipment were readily available onsite and designated solely for those repairs.

b. Findings

No findings of significance were identified.

.9 Reactor Coolant Pump Oil Collection Systems

The guidelines established by BTP CMEB 9.5-1, Section C.7.a, “Primary and Secondary Containment,” paragraph (1)(e), required that “the reactor coolant pumps should be equipped with an oil collection system if the containment is not inerted during normal operations... Such collection systems should be capable of collecting lube oil from all potential pressurized and unpressurized leakage... Leakage should be collected and drained to a vented closed container that can hold the entire lube oil system inventory....”

The licensee stated in the Braidwood Station’s FPR, Chapter 3, “Guidelines of BTP 9.5-1,” that the Braidwood Station’s FPP complied with the above requirement.

a. Inspection Scope

The inspectors reviewed the drawings and design specifications for the RCP oil collection system.

b. Findings

No findings of significance were identified.

.10 Fire Protection Systems, Features and Equipment

The guidelines established by BTP CMEB 9.5-1, which was analogous to 10 CFR Part 50, Appendix R, required that fire protection systems, features and equipment were designed in accordance with the following:

Fire Protection Systems, Features and Equipment	BTP CMEB 9.5-1 Section	BTP CMEB 9.5-1 Title
Fire Brigade Capabilities	C.3	Fire Brigade
Passive Fire Protection Features	C.5.a	Building Design
Fire Detection System	C.6.a	Fire Detection
Fire Suppression System	C.6.b	Fire Protection Water Supply Systems
	C.6.c	Water Sprinkler and Hose Standpipe Systems
Manual Fire Fighting Equipment	C.6.f and C.3	Portable Extinguishers and Fire Brigade

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirements.

a. Inspection Scope

The inspectors reviewed material condition, operations line-up, operational effectiveness and design of fire detection systems, fire suppression systems, manual fire fighting equipment, fire brigade capability, and passive fire protection features. The inspectors also reviewed deviations, detector placement drawings, fire hose stations drawings, carbon dioxide pre-operational test reports, and fire hazard analysis reports to ensure that selected fire detection systems, carbon dioxide systems, portable fire extinguishers, and hose stations were installed in accordance with their design, and that their design was adequate given the current equipment layout and plant configuration.

b. Findings

No findings of significance were identified.

.11 Compensatory Measures

The Braidwood Station's Technical Specification, Chapter 5.0, "Administrative Controls," Section 5.4, "Procedures," paragraph 1c, required, in part, that written procedures shall be established, implemented, and maintained which covered the FPP implementation.

a. Inspection Scope

The inspectors reviewed the Braidwood Station's administrative procedures to verify that adequate compensatory measures were put in place by the licensee for out-of-service, degraded of inoperable fire protection and post-fire safe shutdown equipment, systems, or features. The inspectors also verified that short term compensatory measures were adequate to compensate for a degraded function or feature until appropriate corrective actions were taken.

b. Findings

No findings of significance were identified.

.12 Identification and Resolution of Problems

The guidelines established by BTP CMEB 9.5-1, Section C.4, "Quality Assurance [QA] Program," paragraph h, required that measures should be established to ensure that conditions adverse to fire protection, such as failures, malfunctions, deficiencies, deviations, defective components, uncontrolled combustible material and nonconformance, are promptly identified, reported, and corrected.

The licensee stated in the Braidwood Station's FPR, Chapter 3, "Guidelines of BTP 9.5-1," that the Braidwood Station's FPP complied with the above requirement since tests of the fire protection equipment and systems were included in regularly scheduled operating surveillance procedures. In addition, if nonconforming equipment was identified as a result of these tests then corrective actions were taken to rectify any deficiencies as provided by the QA program.

a. Inspection Scope

The inspectors reviewed the Braidwood Station's Corrective Action Program (CAP) to determine whether the licensee was identifying FPP issues at an appropriate threshold and had entered the FPP issues into the Braidwood Station's CAP. The inspectors selected samples of CAP documents for review, such as, problem identification forms/condition reports, disposition requests, corrective maintenance work orders, and fire system and components condition reports.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA5 Management Meetings

Exit Meeting Summary

On June 16, 2000, at the conclusion of the on-site inspection activities, the inspectors presented their initial findings with plant personnel at a debriefing held at the Braidwood Station. On August 18, 2000, the team leader and senior NRC management presented preliminary inspection results to Mr. T. Tulon, Senior Vice President and other licensee staff at an exit meeting held at the Braidwood Station. On October 5, 2000, the team leader and senior NRC management conducted a public exit meeting held at the NRC's Region III offices in Lisle, Illinois, to further discuss the results of the inspection findings. Information provided to the NRC subsequent to the public exit meeting held on October 5, 2000, resulted in a telephone re-exit on November 30, 2000. Licensee representatives acknowledged the NRC concerns.

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

4OA7 Licensee Identified Violations

Inadequate Administrative Controls for Safe Shutdown Equipment

ESW Suction Valves Not Protected from Fire Induced Spurious Actuations

The Fire Protection Report, Section 2.4.1.5.5.b, stated that a spurious operation analysis was performed and referenced the response to FSAR Question 10.65. The licensee's response to FSAR Question 10.65, dated July 1987, stated, in part, that the circuit breakers supplying power to essential service water (ESW) suction valves 1/2SX001A and 1/2SX001B, would be de-energized during normal plant operation to preclude spurious operation of these valves.

During the licensee's self-assessment activities in May 2000, prior to the NRC inspection, the licensee identified that the circuit breakers supplying power to ESW suction valves (1SX001A, 1SX001B, 2SX001A and 2SX001B) were not de-energized during normal plant operations in accordance with the response to FSAR Question 10.65. These valves supplied ESW to both units. The power removal commitment was to ensure that the valves would not close due to fire-induced spurious operations. The licensee documented this deficiency in Problem Identification Form (PIF) A2000-02077. The licensee determined that it was not reportable or risk significant, since a cross-tie capability to the other unit could have been performed using procedure(s) 1(2) Bw0A PRI-8, "Essential Service Water Malfunction." The cross-tie capability was required to be operable per Tech Spec 3.7.8 and was described in the plant licensing basis. However, there was no directions in BwOA PRI-5 to implement the BwOA PRI-8 recovery of ESW. In addition, the licensee did not demonstrate that the cross-tie capability would not be affected by fire since the valves were not included in the SSEL and were not analyzed. If the valves experienced fire-induced failures (e.g., either close or open) during the fire

event, the potential loss of ESW could cause the operators to embark on time consuming troubleshooting activities and detract them from time critical safe shutdown operations.

A revision was made to the operating procedures in 1986 to energize these valves. Since these valves were not included in the SSEL, the procedural error was not precluded in advance. Failure to de-energize these breakers is a violation of the Braidwood Station's Facility Operating License. However, because the licensee entered the issue into its corrective action program, this issue will not be cited in accordance with Section VI.A.1 of the NRC Enforcement Policy. (NCV 50-456/00-06-08(DRS); 50-457/00-06-08(DRS))

ATTACHMENT 1

REQUEST FOR ADDITIONAL INFORMATION
TO SUPPORT RESOLUTION OF UNRESOLVED ITEMS

Issue 1: Provide a description of the safe shutdown licensing basis for Fire Zones 11.5-0 and 11.6-0.

Issue 2: Assuming a fire in Fire Zones 11.5-0 or 11.6-0, describe the provisions incorporated in the Braidwood Station's Fire Protection Program that assure for any fire-induced failures to the charging system that these failures will not prevent operation of the safe shutdown method credited for each fire zone.

Issue 3: Assuming a fire in Fire Zones 11.5-0 or 11.6-0 that results in fire-induced failures that include degradation to RCP seal integrity, describe the provisions incorporated in the Braidwood Station's Fire Protection Program that assure fire protection safe shutdown performance objectives are met and RCP seal integrity is maintained.

Issue 4: Describe the safe shutdown analysis and methodology used to ensure proper re-classification of Fire Zones 11.5-0 and 11.6-0 from areas requiring safe shutdown capability to alternative or dedicated shutdown capability.

Issue 5: When the Braidwood Station's spurious operational analysis was performed, were combinations of fire-induced failures (i.e., hot shorts, open circuits, and shorts to ground) considered in a single circuit, or was a spurious actuation that required more than one failure screened from further analysis?

Issue 6: Can fire damage to cables associated with the Plant Process Computer (PPC) located in the RSP rooms result in erroneous indication parameters being displayed at the RSP PPC? Specifically, can fire damage to the PPC result in operators believing RCP seal temperatures are still acceptable, when in fact they are not?

PARTIAL LIST OF PERSONS CONTACTED

Licensee

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R. Belair, Modification Design Engineer
F. Beutler, IPEEE Support Engineer
B. Boyle, Fire Marshall
M. Cassidy, Regulatory Assurance - NRC Coordinator
S. Chingo, Fire Protection Engineer
T. Cole, System Engineer
C. Dunn, Operations Manager
C. Furlow, Modification Design Engineer
M. Kon, Modification Design Engineer
F. Lentine, Design Engineering Manager
T. Luke, Engineering Manager
G. O'Donnell, Fire Protection Engineer
J. Panici, Modification Design Engineer
D. Radice, Modification Design Engineer
P. Raush, Operations Supervisor
D. Riedinger, Modification Design Engineer
D. Roberts, Fire Protection Engineer
D. Robinson, SSA Support Engineer
T. Simpkin, Regulatory Assurance Manager
D. Skoza, System Engineer Group Leader
M. Trusheim, Operations Unit Planner
T. Tulon, Site Vice President
R. Wolen, Modification Design Engineer

NRC

R. Gardner, Branch Chief, Electrical Engineering Branch
C. Phillips, Senior Resident Inspector
S. Reynolds, Deputy Director, Division of Reactor Safety
J. Grobe, Director, Division of Reactor Safety

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-456/00-06-01(DRS); 50-457/00-06-01(DRS)	URI	Equipment Important for Safe Shutdown Not Identified (Section 1R05.1b)
50-456/00-06-02(DRS); 50-457/00-06-02(DRS)	URI	License Requirements Reduced for Two Auxiliary Building Fire Zones (Section 1R05.2b)
50-456/00-06-03(DRS); 50-457/00-06-03(DRS)	URI	Effects of Associated Circuits Not Isolated from Safe Shutdown Equipment (Section 1R05.3b)
50-456/00-06-04(DRS); 50-457/00-06-04(DRS)	URI	Alternative Shutdown Capability Was Not Independent of Fire Zone 11.5-0 and Did Not Ensure Integrity of the Primary Coolant Boundary (Section 1R05.4b.(1))
50-456/00-06-05(DRS); 50-457/00-06-05(DRS)	URI	Alternative Shutdown Capability Was Not Independent of Fire Zone 11.6-0 (Section 1R05.4b.(2))
50-456/00-06-06(DRS); 50-457/00-06-06(DRS)	NCV	Molded Case Circuit Breakers Not Periodically Inspected and Tested (Section 1R05.5b.(1))
50-456/00-06-07(DRS); 50-457/00-06-07(DRS)	NCV	Instrumentation Not Available for Determining RCP Seal Temperature (Section 1R05.5b.(2))
50-456/00-06-08(DRS); 50-457/00-06-08(DRS)	NCV	ESW Suction Valves Not Protected from Fire Induced Spurious Actuations (Section 4OA7.1)

Closed

50-456/00-06-06(DRS); 50-457/00-06-06(DRS)	NCV	Molded Case Circuit Breakers Not Periodically Inspected and Tested (Section 1R05.5b.(1))
50-456/00-06-07(DRS); 50-457/00-06-07(DRS)	NCV	Instrumentation Not Available for Determining RCP Seal Temperature (Section 1R05.5b.(2))
50-456/00-06-08(DRS); 50-457/00-06-08(DRS)	NCV	ESW Suction Valves Not Protected from Fire Induced Spurious Actuations (Section 4OA7.1)

Discussed

None

LIST OF BASELINE PROCEDURES PERFORMED

The following procedure was used to perform the inspection during the report period. Documented findings are contained in the body of the report.

Inspection Procedure(s)

Number	Title
71111.05	Fire Protection

LIST OF ACRONYMS USED

ac	Alternating Current
AEER	Auxiliary Electric Equipment Room
BTP	Branch Technical Position
BwHP	Braidwood Electrical Maintenance Surveillance Procedure
BwOA	Braidwood Operating Abnormal Procedure
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CMEB	Chemical Engineering Branch
CVCS	Chemical Volume Control System
dc	Direct Current
ESW	Essential Service Water
FPP	Fire Protection Program
FPR	Fire Protection Report
GL	Generic Letter
IN	Information Notice
IPEEE	Individual Plant Examination of External Events
MCR	Main Control Room
MOV	Motor Operated Valve
MSIV	Main Steam Isolation Valve
NFPA	National Fire Protection Association
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulations
PIF	Problem Identification Form
PORV	Power Operated Relief Valve
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RSP	Remote Shutdown Panel
RWST	Refueling Water Storage Tank
SDP	Significance Determination Process
SI	Safety Injection System
SSA	Safe Shutdown Analysis
SSEL	Safe Shutdown Equipment List
SSPS	Solid State Protection System
URI	Unresolved Item
VCT	Volume Control Tank

LIST OF DOCUMENTS REVIEWED

ADMINISTRATIVE PROCEDURES

NUMBER	DESCRIPTION	REVISION
BwAP 1100-1	Fire Protection Program	3E2
BwAP 1100-2	Implementing Procedure For Fire: Fire Marshal	1E1
BwAP 1100-3	Fire Chief (Designated Field Supervisor) Implementing Procedure	2E2
BwAP 1100-4	Fire Brigade Implementing Procedure	2E1
BwAP 1100-6	Implementing Procedure for the Pre-fire Plans	1E1
BwAP 1110-1	Fire Protection Program System Requirements	10
BwAP 1110-2	Fire Protection Surveillance Performance Guidelines	3
BwAP 2321-25	Plant Design Changes	6
BwAP 320-1	Shift Manning	12
SH-AA-111	Heat Stress Controls	1

CALCULATIONS

NUMBER	TITLE	REVISION
BRW-96-037	Thermal Endurance Evaluation of SX Pumps	0
BRW-96-398-E	Thermal Endurance Evaluation of CV Pumps	0
19-T-6	Diesel Generator Loading During LOOP/LOCA - Braidwood Units 1 & 2	4

ELECTRICAL DRAWINGS

NUMBER	TITLE	REVISION
20E-0-3779B, Sheet 1	Station Emergency Lighting Battery Operated Light Units	H
20E-0-3779B, Sheet 2	Station Emergency Lighting Battery Operated Light Units	P
20E-0-3779B, Sheet 3	Station Emergency Lighting Battery Operated Light Units	N
20E-0-3779B, Sheet 4	Station Emergency Lighting Battery Operated Light Units	K
20E-0-3779B, Sheet 5	Station Emergency Lighting Battery Operated Light Units	E

ELECTRICAL DRAWINGS

NUMBER	TITLE	REVISION
20E-1-4001A	Unit 1 Electrical Single Line Drawing	K
20E-1-4001B	Unit 1 Electrical Single Line Drawing	P
20E-1-4001C	Unit 1 Electrical Single Line Drawing	H
20E-1-4001D	Unit 1 Electrical Single Line Drawing	N
20E-1-4001E	Unit 1 Electrical Single Line Drawing	M
20E-1-4001F	Unit 1 Electrical Single Line Drawing	P
20E-1-4001G	Unit 1 Electrical Single Line Drawing	J
20E-2-4001A	Unit 2 Electrical Single Line Drawing	K
20E-2-4001B	Unit 2 Electrical Single Line Drawing	J
20E-2-4001C	Unit 2 Electrical Single Line Drawing	H
20E-2-4001D	Unit 2 Electrical Single Line Drawing	K
20E-2-4001E	Unit 2 Electrical Single Line Drawing	G
20E-2-4001F	Unit 2 Electrical Single Line Drawing	H

MAINTENANCE PROCEDURES

NUMBER	DESCRIPTION	REVISION
BwHP 4200-033	Temporary Restoration Of Safe Shutdown Components	2
BwMP 3110-012	Reactor Coolant Pump Motor 10-Year Inspection	4
BwMP 3110-018	Reactor Coolant Pump 1 Year Motor Inspection	1
BwMP 3300-090	Removal/Installation of RF Sump Covers and Cleaning of Sump in Support of Refuel Outage	2E1
CC-AA-206	Fuse Control Program	0
MA-AA-OA-2-00011	Calibration of Protective Relays	0
MA-AP-EM-5-00100	Preventive Maintenance of Westinghouse Type DS 480V Circuit Breakers	0
MA-BR-EM-1-3.8.a.3-1	Surveillance for Inspection and Testing of 480 Volt Motor Control Center (MCC) Draw out Units	2

MAINTENANCE PROCEDURES

NUMBER	DESCRIPTION	REVISION

OPERATING PROCEDURES

NUMBER	DESCRIPTION	REVISION
0BwOA PRI-5	Control Room Inaccessibility Unit 0	57
1BwOA PRI-5	Control Room Inaccessibility Unit 1	57C
2BwOA PRI-5	Control Room Inaccessibility Unit 2	57D
1BwOA ELEC-3	Loss of 4kV ESF Bus Unit 1	56
2BwOA ELEC-3	Loss of 4kV ESF Bus Unit 2	56
1BwOA ELEC-5	Local Emergency Control of Safe Shutdown Equipment - Unit 1	54
1BwOA ELEC-5	Local Emergency Control of Safe Shutdown Equipment - Unit 1	54

PIPING AND INSTRUMENTATION DIAGRAMS (P&IDS)

NUMBER	DESCRIPTION	REVISION
M-35, Sheet 1	Diagram of Main Steam Unit 1	AR
M-35, Sheet 8	Diagram of Main Steam Unit 1	C
M-37	Diagram of Auxiliary Feedwater Unit 1 (Critical Control Room Drawing)	BD
M-42, Sheet 1A	Diagram of Essential Service Water Units 1 & 2	BA
M-42, Sheet 1B	Diagram of Essential Service Water Units 1 & 2 (Critical Control Room Drawing)	BA
M-42, Sheet 2A	Diagram of Essential Service Water Units 1 & 2 (Critical Control Room Drawing)	AR
M-42, Sheet 2B	Diagram of Essential Service Water Units 1 & 2 (Critical Control Room Drawing)	AR
M-42, Sheet 3	Diagram of Essential Service Water Unit 1 - 3 Frames (Critical Control Room Drawing)	BJ
M-42, Sheet 4	Diagram of Essential Service Water Unit 1 (Critical Control Room Drawing)	AV
M-42, Sheet 5A	Diagram of Essential Service Water (Primary Containment Vent System) Unit 1 (Critical Control Room Drawing)	AH

PIPING AND INSTRUMENTATION DIAGRAMS (P&IDS)

NUMBER	DESCRIPTION	REVISION
M-42, Sheet 5B	Diagram of Essential Service Water (Primary Containment Vent System) Unit 1 (Critical Control Room Drawing)	AJ
M-42, Sheet 6	Diagram of Essential Service Water (Critical Control Room Drawing)	R
M-50, Sheet 1A	Diagram of Diesel Fuel Oil Unit 1	AW
M-50, Sheet 1B	Diagram of Diesel Fuel Oil Unit 1	AW
M-50, Sheet 3	Diagram of Diesel Fuel Oil Unit 1	AU
M-60, Sheet 1A	Diagram of Reactor Coolant Loop - 1	BA
M-60, Sheet 1B	Diagram of Reactor Coolant Loop - 1 Unit 1 (Critical Control Room Drawing)	BD
M-60, Sheet 2	Diagram of Reactor Coolant Loop - 2 Unit 1	BB
M-60, Sheet 3	Diagram of Reactor Coolant Loop - 3 Unit 1	BC
M-60, Sheet 4	Diagram of Reactor Coolant Loop - 4 Unit 1	BD
M-60, Sheet 5	Diagram of Reactor Coolant Unit 1 (Critical Control Room Drawing)	AM
M-60, Sheet 6	Diagram of Reactor Coolant Unit 1 (Critical Control Room Drawing)	AL
M-60, Sheet 8	Diagram of Reactor Coolant (PZR PORV Accumulators) (Critical Control Room Drawing)	AG
M-61, Sheet 1A	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing)	BC
M-61, Sheet 1B	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing)	BC
M-61, Sheet 2	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing	AH
M-61, Sheet 3	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing)	AN
M-61, Sheet 4	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing)	AX
M-61, Sheet 5	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing)	AA
M-61, Sheet 6	Diagram of Safety Injection Unit 1 (Critical Control Room Drawing)	AV
M-62	Diagram of Residual Heat Removal Unit 1 (Critical Control Room Drawing)	BM
M-64, Sheet 1	Diagram of Chemical & Volume Control & Boron Thermal Regeneration Unit 1 (Critical Control Room Drawing)	AJ
M-64, Sheet 2	Diagram of Chemical & Volume Control & Boron Thermal Regeneration Unit 1 (Critical Control Room Drawing)	AN
M-64, Sheet 3A	Diagram of Chemical & Volume Control & Baron Thermal Regeneration Unit 1 (Critical Control Room Drawing)	BD

PIPING AND INSTRUMENTATION DIAGRAMS (P&IDS)

NUMBER	DESCRIPTION	REVISION
M-64, Sheet 3B	Diagram of Chemical & Volume Control & Baron Thermal Regeneration Unit 1 (Critical Control Room Drawing)	A
M-64, Sheet 4A	Diagram of Chemical & Volume Control & Boron Thermal Regen. Unit 1 (Critical Control Room Drawing)	F
M-64, Sheet 4B	Diagram of Chemical & Volume Control & Boron Thermal Regen. Unit 1 (Critical Control Room Drawing)	E
M-64, Sheet 5	Diagram of Chem. & Volume Control & Boron Thermal Regen. Unit 1 (Critical Control Room Drawing)	BD
M-66, Sheet 1A	Diagram of Component Cooling Unit 1 (Critical Control Room Drawing)	AN
M-66, Sheet 1B	Diagram of Component Cooling Unit 1 (Critical Control Room Drawing)	AM
M-66, Sheet 2	Diagram of Component Cooling Unit 1 (Critical Control Room Drawing)	AN
M-66, Sheet 3A	Diagram of Component Cooling Units 1 & 2 (Critical Control Room Drawing)	AT
M-66, Sheet 3B	Diagram of Component Cooling Units 1 & 2 (Critical Control Room Drawing)	AV
M-66, Sheet 4A	Diagram of Component Cooling Units 1 & 2 (Critical Control Room Drawing)	BA
M-66, Sheet 4B	Diagram of Component Cooling Units 1 & 2 (Critical Control Room Drawing)	BA
M-66, Sheet 4C	Diagram of Component Cooling Units 1 & 2 (Critical Control Room Drawing)	AV
M-66, Sheet 4D	Diagram of Component Cooling Units 1 & 2 (Critical Control Room Drawing)	BC
M-95, Sheet 1	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	P
M-95, Sheet 2	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	AC
M-95, Sheet 3	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	L
M-95, Sheet 4	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	T
M-95, Sheet 5	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	N
M-95, Sheet 6	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	N
M-95, Sheet 7	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	V
M-95, Sheet 8	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	V
M-95, Sheet 9	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	R
M-95, Sheet 10	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	L

PIPING AND INSTRUMENTATION DIAGRAMS (P&IDS)

NUMBER	DESCRIPTION	REVISION
M-95, Sheet 11	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	S
M-95, Sheet 12	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	Y
M-95, Sheet 13	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	H
M-95, Sheet 14	Diagram of Auxiliary Building HVAC (VA) System Units 1 & 2	AC
M-95, Sheet 15	Diagram of Auxiliary Building HVAC (VA) System Cubicle Cooler Units 1 & 2	P
M-96, Sheet 1	Diagram of Control Room HVAC System Units 1 & 2 (Critical Control Room Drawing)	AK
M-96, Sheet 2	Diagram of Control Room HVAC System Units 1 & 2 (Critical Control Room Drawing)	AL
M-96, Sheet 3	Diagram of Control Room HVAC System Units 1 & 2	T
M-96, Sheet 4	Diagram of Control Room HVAC System Units 1 & 2	W
M-97	Diagram of Diesel Generator Room 1A & 1B Ventilation System Unit 1	V
M-98	Diagram of Diesel Generator Room 2A & 2B Ventilation System Unit 2	U
M-103, Sheet 2	Diagram of Primary Containment Vent. System (VP) Unit 1	D
M-104, Sheet 2	Diagram of Primary Containment Vent. System (VP) Unit 2	E
M-115	Diagram of ESS & Non-ESS Switch Gear Misc Elect. Equip. Rm. Vent. Sys. Unit 1	V
M-116	Diagram of ESS & Non-ESS Switch Gear Misc Elect. Equip. Rm. Vent. Sys. Unit 2	V
M-120, Sheet 1	Diagram of Main Steam Unit 2	AJ
M-120, Sheet 2A	Diagram of Main Steam Unit 2	AC
M-120, Sheet 2B	Diagram of Main Steam Unit 2	AC
M-120, Sheet 8	Diagram of Main Steam Unit 2	B
M-122	Diagram of Auxiliary Feedwater Unit 2 (Critical Control Room Drawing)	AW
M-126, Sheet 1	Diagram of Essential Service Water Unit 2 (Critical Control Room Drawing)	BK
M-126, Sheet 2	Diagram of Essential Service Water Unit 2 (Critical Control Room Drawing)	AF
M-126, Sheet 3	Diagram of Essential Serv. Wtr. (Primary Containment Vent System Unit 2 (Critical Control Room Drawing)	AG

PIPING AND INSTRUMENTATION DIAGRAMS (P&IDS)

NUMBER	DESCRIPTION	REVISION
M-130, Sheet 1A	Diagram of Diesel Oil and Fuel Oil Supply Unit 2 (Critical Control Room Drawing)	BJ
M-130, Sheet 1B	Diagram of Diesel Oil and Fuel Oil Supply Unit 2 (Critical Control Room Drawing)	BG
M-135, Sheet 1A	Diagram of Reactor Coolant Loop 1 Unit 2 (Critical Control Room Drawing)	BC
M-135, Sheet 1B	Diagram of Reactor Coolant Loop 1 Unit 2 (Critical Control Room Drawing)	BD
M-135, Sheet 2	Diagram of Reactor Coolant Loop 2 Unit 2 (Critical Control Room Drawing)	AW
M-135, Sheet 3	Diagram of Reactor Coolant Loop 3 Unit 2 (Critical Control Room Drawing)	BB
M-135, Sheet 4	Diagram of Reactor Coolant Loop 4 Unit 2 (Critical Control Room Drawing)	BA
M-135, Sheet 5	Diagram of Reactor Coolant Unit 2 (Critical Control Room Drawing)	AT
M-135, Sheet 6	Diagram of Reactor Coolant Unit 2 (Critical Control Room Drawing)	AN
M-135, Sheet 8	Diagram of Reactor Coolant Unit 2 (Critical Control Room Drawing)	AC
M-136, Sheet 1	Diagram of Safety Injection Unit 2	BG
M-136, Sheet 2	Diagram of Safety Injection Unit 2 (Critical Control Room Drawing)	AD
M-136, Sheet 3	Diagram of Safety Injection Unit 2 (Critical Control Room Drawing)	AU
M-136, Sheet 4	Diagram of Safety Injection Unit 2	AY
M-136, Sheet 5	Diagram of Safety Injection Unit 2 (Critical Control Room Drawing)	U
M-136, Sheet 6	Diagram of Safety Injection Unit 2 (Critical Control Room Drawing)	AM
M-137	Diagram of Residual Heat Removal Unit 2 (Critical Control Room Drawing)	BD
M-138, Sheet 1	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	AU
M-138, Sheet 2	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	AU
M-138, Sheet 3A	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	BC
M-138, Sheet 3B	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	AY

PIPING AND INSTRUMENTATION DIAGRAMS (P&IDS)

NUMBER	DESCRIPTION	REVISION
M-138, Sheet 4A	Diagram of Chem.& Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	BM
M-138, Sheet 4B	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	BF
M-138, Sheet 5A	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	E
M-138, Sheet 5B	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	D
M-138, Sheet 5C	Diagram of Chem. & Volume Control & Boron Thermal Regeneration Unit 2 (Critical Control Room Drawing)	C
M-139, Sheet 1	Diagram of Component Cooling Unit 2 (Critical Control Room Drawing)	AT
M-139, Sheet 2	Diagram of Component Cooling Unit 2 (Critical Control Room Drawing)	AG

PLANT LAYOUT AND EQUIPMENT DRAWINGS

NUMBER	DESCRIPTION	REVISION
M-3	Plant Development Units 1 & 2	V
M-6	General Arrangement Main Floor at El. 451'-0" Units 1 & 2	L
M-7	General Arrangement Mezzanine Floor at El. 426'-0" Units 1 & 2	T
M-8	General Arrangement Grade Floor at El. 401'-0" Units 1 & 2	T
M-9	General Arrangement Floor Plan at El. 383'-0" Units 1 & 2	T
M-10	General Arrangement Basement Floor at El. 364'-0" Units 1 & 2	M
M-11	General Arrangement Floor Plan at El. 346'-0" Units 1 & 2	P
M-13	General Arrangement Fuel Handling Building Units 1 & 2	J
M-14	General Arrangement Section "A-A" Units 1 & 2	H
M-15	General Arrangement Section "B-B" Units 1 & 2	J
M-16	General Arrangement Section "C-C" & "D-D" Units 1 & 2	H
M-17	General Arrangement Section "E-E" Units 1 & 2	K
M-18	General Arrangement Section "F-F" Units 1 & 2	J
M-19	General Arrangement Lake Screen House Units 1 & 2	G

PLANT LAYOUT AND EQUIPMENT DRAWINGS

NUMBER	DESCRIPTION	REVISION
M-48, Sheet 44	Diagram of Reactor Coolant Pump Drip Pans Units 1 & 2	E
M-1249, Sheet 1	Containment Building Reactor Coolant Pump Motor Drip Pans Units 1 & 2	G
M-1249, Sheet 2	Containment Building Reactor Coolant Pump Motor Drip Pans Units 1 & 2	F
M-1249, Sheet 3	Containment Building Reactor Coolant Pump Motor Drip Pans Units 1 & 2	E

REFERENCES

NUMBER	TITLE	REVISION
NFPA 12	Carbon Dioxide Extinguishing Systems	1985
NFPA 20	Centrifugal Fire Pumps	1983
NUREG 876	SER for Byron 1 & 2	
NUREG 1002	SER for Braidwood 1 & 2	