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Facility:	Braidwood Nuclear Plant, Units 1 and 2
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Dates:	February 22 - April 7, 1997
Inspectors:	C. Phillips, Senior Resident Inspector J. Adams, Resident Inspector T. Esper, Illinois Department of Nuclear Safety
Approved by:	R. D. Lanksbury, Chief, Projects Branch 3 Division of Reactor Projects

EXECUTIVE SUMMARY

Braidwood Nuclear Plant, Units 1 & 2
NRC Inspection Report 50-456/97005; 50-457/97005

This inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a 6-week period of resident inspection. The use of a plant barrier impairment to track maintenance discussed in Section M2.1 and the use of a plant barrier impairment instead of a 10 CFR 50.59 safety evaluation discussed in Section E2.1 demonstrated an improper use of the plant barrier impairment program.

Operations

- The licensee's preparation for and execution of Unit 1 shutdown for refueling on March 29, 1997, was excellent. Operations staff and management attention to shutdown operations was good. Continuous discussion and short briefings between procedure steps demonstrated good communications and strong team work. Plant systems needed for cooldown were observed to be available and in good working condition. (Section O1.2)

- The inspectors concluded that pre-evaluation briefings observed prior to several evolutions were good in that the briefings met or exceeded procedural requirements and were conducted in a manner that encouraged questions and participation. (Section 01.3)

- The inspectors concluded that the positive displacement charging pumps would not operate in accordance with the emergency operating procedure BWFR-S.1, "Response to Nuclear Power Generating/ATWS," Revision 1A. BwFR-S.1 directed operators to start the positive displacement charging pumps if the centrifugal charging pumps would not start. The positive displacement charging pumps had not been started and had been out of service for the last 10 years. Thus, the procedure had been improperly maintained and a Notice of Violation was issued. (Section 03.1)

- Review of operating procedures for plant shutdown, cool-down, and refueling revealed the procedures were adequate. (Section 03.2)

- The inspectors concluded based on several observations that control room turnovers of both Nuclear Station Operators and Unit Supervisors were good. However, the inspectors also found through observations that operator attentiveness to control room panels were weak on several occasions during routine operations in late February and early March. (Section 04.1)

Maintenance

- Maintenance training and prejob preparation for work on the Unit 1 "C" reactor coolant system cold leg stop valve, 1RC8002C, demonstrated good safety focus

and communications between maintenance, engineering, and radiation protection personnel. (Section M5.1)

- The inspectors identified a plant barrier between Fire Zones 11.3-0 and 11.4-0, at auxiliary building elevation 383, column N-18, that had been degraded since June 6, 1996. This barrier was needed to satisfy requirements stated in Deviation A.4 of the Fire Protection Report. No work request to restore the plant barrier could be identified by plant personnel. Therefore, no traceable actions on restoration of the barrier appeared to be in place. A plant barrier impairment was not the correct mechanism for tracking maintenance. A Notice of Violation was issued for failure to take prompt corrective actions. (Section M2.1)

- Maintenance workers demonstrated good work practices and procedural adherence during the observations of three maintenance items. (Sections M2.2, M2.3 and M3.2)

- CV and RH response time test procedures preconditioned the system prior to the measurement of response time. Also, testing that demonstrates the capability of the CV pumps to start under accident conditions did not exist. A Notice of Violation was issued. (Section M3.1)

Engineering

- The inspectors observed that the auxiliary building ventilation system was placed in an abnormal lineup by blocking open the door between the ventilation system exhaust plenum and the auxiliary building. The licensee had not performed an operability or safety evaluation prior to blocking the door open. An evaluation for blocking the door open was documented on a plant barrier impairment. A plant barrier impairment was not the correct mechanism to document an evaluation of operability. The inspectors concluded this was a violation of 10 CFR 50.59 and a Notice of Violation was issued. (Section E2.1)

- During post modification testing, the system engineer identified oil level depletion from the fan inboard bearing for 0VA02CC in the auxiliary building ventilation system. As a result of this timely detection, prompt actions by the engineer may have prevented injury to personnel in the area and possibly prevented damage to plant equipment. (Section E4.1)

Plant Support

- Radiation protection support for modification testing on the auxiliary building ventilation system on March 4, 1997, was prompt and efficient. (Section E4.1)

- Prompt appropriate corrective actions were taken by the licensee to reduce dose rates in the auxiliary building floor drain tank pump room shortly after a hot spot was identified during routine surveys. This resulted in a reduced possibility of unnecessary exposure. (Section R1.1)

- Radiation protection preparations for repair work on the 1C reactor coolant system, cold loop stop valve were comprehensive and adequate for the scope of the work. (Section R4.1)

Report Details

Summary of Plant Status

Unit 1 entered the period at or near 100% full power and operated routinely until March 29, 1997, when the unit was shut down for refueling. Estimated duration of the refueling outage was 53 days.

Unit 2 entered the period at or near 100% full power and operated routinely for the entire period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

a. Inspection Scope

The inspectors conducted frequent reviews of on-going plant operations. Walkdowns were performed in the main control room, auxiliary building, turbine building, and technical support center. The following items were verified during the walkdowns: technical specification (TS) compliance, equipment availability, indications within normal ranges, proper valve lineups, material condition of rooms and equipment, and general housekeeping. The inspector also discussed plant status and pending evolutions with shift personnel in the control room.

b. Observations and Findings

The licensee was in compliance with procedures and TS, including limiting conditions for operation (LCO) for equipment degraded or out of service. Control room manning was adequate and the operators were not over-burdened. Housekeeping was found to be generally good for Unit 2. Due to preparations for the Unit 1 refueling outage, general area housekeeping was, at times, adversely affected as materials and tools were staged at local work sites. Material condition was generally good.

c. Conclusions

The inspectors concluded that shift personnel appeared to be aware of plant conditions and operational requirements. Walkdowns verified that the equipment, components, rooms, and areas were in generally good condition.

O1.2 Unit 1 Shutdown

a. Inspection Scope (71707)

The inspectors observed control room and shift operations during plant shutdown and prior to unit cool-down.

b. Observations and Findings

Unit 1 was shut down for refueling on March 29, 1997. The inspector observed the following in the control room during shutdown operations:

- Control room access was well controlled. The unit supervisor (US) screened all personnel requesting access and directed personnel to other areas when control room access was not necessary.

- The operations manager was in the control room during portions of the shutdown. Site Quality Verification (SQV) personnel provided around-the-clock monitoring of control room operations.

- Additional Nuclear Station Operators (NSOs) were stationed in the control room to assist in shutdown operations.

- Simulator training was conducted for the appropriate crews for the shutdown and cool-down prior to the actual event.

- A qualified nuclear engineer was in the control room at all times. Communications between the nuclear engineer and control room personnel appeared to be good.

- Communications between operations personnel (within the control room and also between the control room and the operators in the plant) were continuous. Short briefings as to the status of the shutdown and equipment were frequently conducted by the US. Three-way communications techniques were utilized by operators.

The inspectors attended the shift turnover meeting and the heightened level of awareness (HLA) meeting for the operating shift performing unit cool-down. The meetings were conducted satisfactorily and individuals leading the meetings were very knowledgeable of expected conditions. The focus of all meetings was on safety. Operators were specifically instructed to notify management personnel if any schedule pressures were sensed.

The inspectors also performed general system walkdowns for the following systems prior to commencing cooldown:

- Residual Heat Removal
- Component Cooling Water
- Essential Service Water

The systems were found in good condition. All redundant trains were available for service and all major valves were correctly aligned.

c. Conclusions

Preparation for Unit 1 shutdown for refueling was excellent. Operations staff and management attention to shutdown operations was appropriate. Continuous communications using 3-way face to face techniques and short briefings between important steps of the procedure demonstrated strong team work. Plant systems needed for cool-down were available and in acceptable condition.

O1.3 Observations of Operations Briefings

a. Inspection Scope (71707)

The inspectors observed the performance of one Infrequent Plant Activities (IPA) briefing and four Heightened Level of Awareness (HLA) briefings and reviewed BwAP 100-12, "Human Performance Awareness," Revision 4E2.

b. Observations and Findings

The inspectors attended an IPA briefing for the measurement of the moderator temperature coefficient at power. The IPA was led by the Shift Operations Supervisor (SOS). Initially, the IPA was to be held in the control room, but an on duty licensed operator expressed a concern to the SOS that there were too many people in the control room. The SOS agreed and moved the IPA to the shift briefing room. The inspectors observed that 22 personnel attended the IPA. The IPA briefing covered the sequence of activities, communications, responsibilities, self checking actions, use of a questioning attitude, use of procedures, applicable technical specifications, expected system response, potential problems, and contingency plans. The inspectors observed frequent questions from participants and lengthy periods of discussions.

The inspectors also observed HLA briefings for auxiliary building exhaust fan testing, Unit 1 auxiliary feed pump full flow testing, Unit 1 reactor shutdown and cooldown, and the placing of the Unit 1 residual heat removal system in the shutdown cooling mode. Each HLA was conducted by the US in the control room. The HLA briefings covered the sequence of activities, communications, responsibilities, use of procedures, applicable technical specifications, expected system response, potential problems, and contingency plans. Additionally, during the HLA for the reactor shutdown and cooldown, the US discussed an event that

occurred during the previous Unit 1 shutdown and cooldown that resulted in the lifting of the pressurizer power operated relief valve (PORV). The US reviewed the root causes and corrective actions taken to prevent recurrence with the briefing participants. The inspectors observed the use of checklists by the briefing leaders and frequent questions from the participants.

The inspectors did not observe any reference to maintaining the schedule during any of the briefings. To the contrary, the inspectors observed numerous cautions by management to take the time required to do the job right.

c. Conclusions

The inspectors concluded that the IPA and HLA briefings were conducted by the proper management levels. The manner in which the briefings were conducted encouraged questions and discussion by the briefing's participants. The inspectors concluded that the licensed operator's concern over the number of people in the control room, including the SOS's prompt addressing of the concern was good. The inspectors concluded that all of the briefings were conducted in accordance with BwAP 100-12. Overall, the inspectors concluded that the conduct of the HLA and IPA briefs observed was good.

O3 Operations Procedures and Documentation

O3.1 Emergency Operating Procedure Improperly Maintained

a. Inspection Scope (71707)

The inspectors observed operator simulator training on March 25. The inspectors reviewed procedures 1BwEP-0, "Reactor Trip or Safety Injection," Revision 1A and 1BwFR-S.1, "Response To Nuclear Power Generation/ATWS," Revision 1A.

b. Observations and Findings

The inspectors observed that during a scenario that simulated an anticipated transient without scram (ATWS) 1BwFR-S.1, Step 4a, directed the operator to start both centrifugal charging pumps and if the centrifugal charging pumps could not be started the "Response Not Obtained" column directed the operator to start the positive displacement charging pump. The positive displacement charging pumps at Braidwood have been out-of-service for about 10 years.

c. Conclusions

The inspectors concluded that since the emergency operating procedure directed the operators to start a pump that was not functional and had not been started for the past 10 years, the procedure was not adequately maintained. The failure to maintain the emergency operating procedure was a violation of Technical Specification 6.8.1.a (50-456/97005-01; 50-457/97005-01(DRP)).

O3.2 Review of Plant Shutdown Procedures

a. Inspection Scope (71707)

In preparation for Unit 1 plant shutdown for refueling, the inspector reviewed the following procedures:

- 1BwGP 100-4, Revision 7, "Power Descension"
- 1BwGP 100-5, Revision 12, "Plant Shutdown and Cooldown"
- 1BwGP 100-6, Revision 7E2, "Refueling Outage"

b. Observations and Findings

The procedures adequately directed operations for unit shutdown, unit cool-down, and preparation for refueling. Technical specifications were listed in the procedures and performance of the procedures as listed would satisfy TS requirements.

c. Conclusions

Procedures used for plant shutdown and cool-down were adequate and TS requirements were satisfied by performance of the procedures.

O4 Operator Knowledge and Performance

O4.1 Control Room Observations

a. Inspection Scope (71707)

The inspectors observed operations shift turnovers on February 24 and 25, and again on March 28 and 29. The inspector also verified that shift manning levels met minimum TS requirements. The inspectors noted weaknesses in panel attentiveness over the course of routine control room walkdowns between February 13 and March 14. The following procedures were reviewed:

- BwAP 335-1, "Operating Shift Turnover and Relief," Revision 13
- BwAP 300-3, "Briefings," Revision 1
- BwAP 300-2, "Communications Standard For Operations," Revision 1E3
- BwAP 320-1, "Shift Manning," Revision 8E1
- BwAP 300-1, "Conduct of Operations," Revision 19E1

b. Observations and Findings

The inspectors observed the NSO's and the US's use checklists applicable to their position and conduct control panel walkdowns as part of their turnover. The US and NSOs generally used proper three-way face-to-face communications. The inspectors also verified that shift manning levels met procedural and TS requirements.

However, the inspectors also identified the following weaknesses:

- On February 13, the inspectors observed that there were seven chart recorders that were not properly functioning and had no action requests written.

- On March 12, the inspectors observed that the daily chemistry report showed that on March 11 the Unit 1 volume control tank (VCT) hydrogen pressure was above 20 psig but below 25 psig from 10 a.m. to 6:30 p.m.. The high hydrogen pressure specification is 25 psig but the licensee tries to maintain pressure between 15 and 20 psig for better hydrogen concentration control. Hydrogen pressure in the VCT was monitored and controlled from the main control room.

- On March 12, the inspectors identified that the Unit 2 chart recorder for pressurizer level showed a 6 percent deviation between pressurizer programmed level and actual level for several hours that had gone unnoticed by control room operators. The deviation was later identified by the licensee as a chart recorder problem.

- On March 12, the inspectors observed that during a 1-hour period the Unit 1 NSO attempted to perform a complete panel walkdown three times but was interrupted all three times and never completed the walkdown. The licensee had designated an administrative NSO for each unit specifically to prevent these types of distractions of control board monitoring. During this time period the Unit 1 administrative NSO was not in the Unit 1 area.

- On March 14, the inspectors observed that during a 90-minute period the Unit 1 operator did not make, nor attempt to make, a complete walkdown of the Unit 1 control panels.

BwAP 300-1, Step C.1.b.8) states:

> "Unit NSO's are responsible for Unit operations, the reactor, the reactor panels, and all phases of reactivity management. The primary focus of the Unit NSO is the safety of the reactor. As such, his attention should be directed towards the appropriate panels."

The operators were within the area designated as the "at the controls area," at all times and were not participating in any non-professional activities. BwAP 300-1 does not specifically state how often panel walkdowns should be performed.

c. Conclusions

The inspectors concluded that the performance of shift turnovers was good based on the following observations:

- control room turnovers were performed in accordance with BwAP 335-1;
- control room communications were performed in accordance with BwAP 300-2;
- control room manning levels met or exceeded TS 6.2.2.a and BwAP 320-1;
- shift briefings were conducted in accordance with BwAP 300-3;
- the procedures reviewed were well written and provided clear guidance.

However, the inspectors also concluded, based on observation, that operator attentiveness to panels on several occasion during routine operation in late February and early March was weak.

O4.2 Auxiliary Building Rounds Walkdown and 1B Charging Pump Start

a. Inspection Scope (71707)

The inspectors observed portions of the Unit 1 auxiliary building rounds with the station operations manager on March 18. The operations manager evaluated the non-licensed operator using the stations scorecard program. The inspectors also observed the non-licensed operator during the start of the 1B charging pump.

b. Observations and Findings

The inspectors observed that the operator reviewed the procedure and discussed the start of the 1B charging pump with his supervisor prior to the evolution. Procedural adherence and the communications between the non-licensed operator and the control room operators before and during the evolution were good.

The inspectors observed that there were problems in the plant that were not identified by the operator during his rounds. For example, the inspectors noted a small pool of oil under the 1B auxiliary feedwater pump and observed that the non-licensed operator saw it also. When the operator was about to leave the room the inspectors questioned if an action request had been written to repair the oil leak. The operator did not know and rechecked to find that no action request had been written.

The operations manager changed the scorecard observation form to include an evaluation of the operator's ability to identify problems that were not specifically required to be checked by the rounds package.

c. Conclusions

The inspectors concluded that the operator performed assigned tasks well but had a narrow view of his responsibilities as an operator in the field.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Shutdown Risk Review For Unit 1 Refuel Outage A1R06

a. Inspection Scope (62703)

The inspectors reviewed the outage plan for A1R06 in regard to shutdown risk and interviewed outage planning personnel.

b. Observations and Findings

The inspectors reviewed the licensee's outage schedule, shutdown risk analysis, and contingency action plans. The licensee used Outage Risk Assessment and Management (ORAM) software to evaluate shutdown risk.

The inspectors verified the ORAM assessment versus the actual outage plan. The fuel pool cooling system was to be reduced to one effective heat exchanger train for a period of 2 days because of valve work on the component cooling water system. The inspectors reviewed the licensees estimations on time to boil in the fuel pool and the contingency plans for recovering the fuel pool cooling heat exchanger and had no concerns. In addition, the licensee planned to lower reactor cavity level to the reactor flange level in order to remove the reactor vessel head with one diesel generator and one 125 VDC battery inoperable. The inspectors reviewed the licensee's risk analysis and contingency plans for a loss of offsite power during the evolution and had no concerns.

c. Conclusions

The inspectors concluded that the licensee's outage plan and shutdown risk analysis were acceptable.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Inadequate Seal on Fire Barrier in Auxiliary Building

a. Inspection Scope (62703)

On March 24, 1997, the inspectors observed that concrete floor plugs, located at column N-18 on elevation 383 in the auxiliary building, were not caulked in place. As a result of this observation, the inspector reviewed the following documentation: Plant Barrier Impairment Permit (BwAP 1110-3A1) #7734; BwAP 1110-3, "Plant Barrier Impairment Program," Revision 3; BwAP 1110-1, "Fire Protection Program System Requirements," Revision 5; and applicable portions of the UFSAR. The inspectors also interviewed the station fire marshall, fire protection personnel, system engineering personnel, and station stores personnel.

b. Observations and Findings

The inspectors observed that light was passing between floors in the area of the concrete plugs. Further inspection of the area revealed a sign that stated the concrete plugs must be caulked in place with Dow RT-96-081 in order to satisfy requirements stipulated in Unit 1 Deviation A.4 to Appendix R, as listed in the Fire Protection Report. A plant barrier impairment (PBI) tag was not affixed to the concrete blocks and no action request tag was found in the area.

The UFSAR stated that the Fire Protection Report described fire protection for Braidwood. Deviation A.4 to the Fire Protection Report stated that the floor location between Fire Zones 11.3-0 and 11.4-0 was not fire rated. Since there were cables required for shutdown in both of these zones, the configuration was not in accordance with Section III.G.2 of 10 CFR Part 50, Appendix R. As justification for the deviation, the Fire Protection Report stated that the concrete blocks at column N-18 are in place and sealed with caulk to serve as a smoke and heat barrier.

The inspectors questioned fire protection personnel to determine if a plant barrier impairment permit existed for the condition. PBI Permit Number 7734 had been generated for the concrete block removal to move equipment. This permit was generated on June 6, 1996, and the estimated duration of the impairment on the permit was listed as "14 days." When the inspectors asked about the impairment, it had existed for 9 months and 19 days.

Based on interviews with fire protection personnel, it was found that impairments typically last longer than originally estimated on PBI permits. PBI Permit 7734 was left in effect at that time with the plugs replaced because of a shortage of caulk. However, the inspectors found that ample caulk had been available to complete the project. In addition, fire protection personnel could not identify a work request to caulk the blocks in place and PBI Permit 7734 entry for work request number was listed as "N/A."

The inspectors also checked if compensatory actions were in place for the impairment. A hourly fire watch was stipulated on PBI 7734. The fire watch had been in place since June 1996.

c. Conclusions

A plant barrier between Fire Zones 11.3-0 and 11.4-0 at auxiliary building elevation 383, column N-18 had been degraded since June 6, 1996. This barrier was needed to satisfy requirements stated in Deviation A.4 of the Fire Protection Report. No work request to restore the plant barrier could be identified by plant personnel. As a result, no traceable actions on restoration of the barrier except for the PBI appear to be in place. A plant barrier impairment was not the correct mechanism for tracking maintenance.

Failure to take corrective actions in a timely manner is a violation of 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action (50-456/97005-02; 50-457-97005-02(DRP)).

M2.2 Maintenance Activities on Diesel Driven Fire Pump

a. Inspection Scope (62703)

On February 25, 1997, maintenance was performed on 0FP03PB, diesel driven fire pump, using work request (WR) 960057306. The inspectors reviewed the work package and associated out-of-service for this work. The inspectors also toured the work area.

b. Observations and Findings

Work request 960057306 was generated to repack the shaft seal on the diesel driven fire pump. The inspectors reviewed the work package and verified the package provided adequate instructions to perform the job. The inspectors also performed a walkdown of the out-of-service associated with the job and verified all tags were in place and all components were in the required position.

The inspectors toured the work area in the lake screen house and noted the following observations:

- A copy of the work package was at the work location. Work performed was signed off as complete in the package.
- Foreign material exclusion (FME) controls were in place.
- The work area was neat.
- Tools and parts required for the job were staged at the work site.

c. Conclusions

The inspectors concluded that maintenance workers appeared to be using good work practices while performing work on the 0FP03PB, diesel driven fire pump.

M2.3 2A Reactor Coolant Pump (RCP) Seal Leakoff Flow Transmitter Calibration

a. Inspection Scope (62703)

On March 18, the 2A RCP #1 seal leakoff increased from about 2 gallons per minute to about 4.5 gallons per minute. Sudden increased seal leakoff flow can be an indication of pending seal failure. The licensee wanted to verify the problem was not with the seal leakoff flow transmitter. The inspectors reviewed work request 970032427-01, observed the work performed, and interviewed the maintenance workers.

b. Observations and Findings

The inspectors observed that the work practices and procedural adherence practiced by the instrument maintenance technicians were good. For example, the technicians checked out a torque wrench that had a current calibration sticker attached. The technician checked the wrench prior going into the field and found that the gauge was not functioning properly and the wrench was replaced.

c. Conclusions

The inspectors concluded that the work practices and procedural adherence practiced by the instrument maintenance technicians during the 2A RCP #1 seal leakoff flow transmitter calibration check were good.

M2.4 Surveillance Observations

a. Inspection Scope (61726)

The inspectors observed all or portions of the following surveillance activities:

- BwVS 1.1.3.b-1, "Moderator Temperature Coefficient At Power," Revision 6
- BwVS 7.1.1-1, "Main Steam Safety Valves Operability Tests," Revision 7
- BwVS 800-14, "Unit 1 Full Flow Test and Equipment Response Time of Auxiliary Feedwater Pumps," Revision 1

b. Observations and Findings

The inspectors observed and verified that all surveillances were performed in accordance with their applicable procedure, that equipment operation and performance parameters met acceptance criteria, that proper communications between the control room and personnel in the field occurred, and that all instruments were in calibration. During the performance of BwVS 800-14, the inspector observed the receipt a low level alarm for the diesel driven auxiliary feed pump day tank. Control room operators dispatched an equipment operator to verify

the alarm and to line up to fill the tank. The tank level by local gauge was found 4% below the TS minimum. The control room operators informed the US and properly entered the LCO. The tank was subsequently refilled to above the TS limit and the LCO was exited. The inspectors verified that the system engineer wrote a PIF and an action request (AR) for the calibration of the level instrument. The inspectors reviewed applicable TSs and applicable sections of the Updated Final Safety Analysis Report (UFSAR) and found no discrepancies.

c. Conclusions

The inspectors concluded that the surveillances listed above were performed in accordance with the procedures and all acceptance criteria were met. The inspector also concluded that the procedures were well written and ensured TS and UFSAR requirements were tested.

M3 Maintenance Procedures and Documentation

M3.1 Observation of ASME Surveillance Requirements for the 1B Centritugal Charging Pump and Check Valve 1CV8480B Stroke Test

a. Inspection Scope (61726)

The inspectors observed the performance BwVS 1.2.3.1-2, "ASME Surveillance Requirements for the 1B Centrifugal Charging Pump and Check Valve 1CV8480B Stroke Test," Revision 7. The inspectors reviewed the following documents:

- BwVS 1.2.3.1-2, "ASME Surveillance Requirements for the 1B Centrifugal Charging Pump and Check Valve 1CV8480B Stroke Test," Revision 7,
- BwVS 0.5-2.SI.2-3, "Safety Injection System Check Valve Stroke Test," Revision 7,
- 1BwVS 8.1.1.2.f-13, "1A Diesel Generator 24 Hour Load Test and ECCS Surveillance," Revision 8,
- 1BwVS 3.2.2-2a, "Unit 1 Engineered Safety Features Response Time Compilation for Mode 4 Required Equipment, Revision 3.,
- Braidwood Technical Specifications, Sections 3.1.2 and 3.5, and
- Braidwood UFSAR Section 6.3.2.2

b. Observations and Findings

The inspectors observed that the system engineer and supporting field operators used proper work practices and radiological precautions. The inspectors verified that UFSAR and TS requirements were tested by the surveillance.

The inspectors conducted an interview with the system engineer following the performance of the surveillance and asked if the manual start of the 1B Centrifugal Charging Pump Aux Lube Oil Pump (1CV01PB-A) prior the start of the 1B Centrifugal Charging (CV) Pump was preconditioning the system. After some thought, the system engineer indicated that he did not consider the action to be preconditioning and thought the practice was desirable to minimize bearing wear on pump start-up. The inspectors asked the system engineer if there was a procedure that tested the system response without first manually starting 1CV01PB-A. The system engineer was unable to provide any procedure that tested the start of a CV pump without first performing a manual start of the auxiliary lube oil pump.

The inspectors reviewed other surveillances that required the use of the CV pumps. Two procedures, 1BwVS 8.1.1.2.F-13, "1A Diesel Generator 24-Hour Load Test and ECCS Surveillance," Revision 8, and BwVS O.5.SI.2-3, "Safety Injection System Check Valve Stroke Test," Revision 7, were identified that started the aux oil pump before providing a start signal to the associated CV pump. Procedure 1BwVS, Step 8.1.1.2.f-13, manually starts the aux oil pump for the CV pump powered from the diesel train to be tested, followed by the manual start of the associated CV pump. A bus undervoltage condition is caused by opening the transformer supply breaker to associated 4kV 1E bus and the CV pump is load shed. Approximately 10 seconds later, following the closing of the diesel generator output breaker onto the 4kV 1E bus, the CV pump is started by the load sequencer. This was the only time identified where the CV pump is started without first having the aux oil pump running.

The inspectors observed that BwVS 0.5-2.SI.2-3, "Safety Injection System Check Valve Stroke Test," provided another example of CV pump preconditioning. The aux oil pump for the CV pump train to be tested is manually started, the CV pump is manually started. Flow control valves were throttled to simulate a reactor coolant pump seal injection flow of 80 gpm and to obtain loop injection flow rates greater than 100 gpm for each reactor coolant loop. The CV pump is shutdown and response time measurement equipment started. The CV pump was then manually started and the time measured from the placement of the CV pump control switch in the start position until stable injection flow conditions were observed. The inspectors observed that all active components in the tested CV pump train would be exercised prior to the measurement of the train's response time. The response time measured was used as input data to 1BwVS 3.2.2-2a, which was used to satisfy the requirement of TS 4.3.2.2 which stated that the engineered safety feature response time of each engineered safety feature actuation system should be verified to be within the limit at least once per 18 months.

c. Conclusion

The inspectors concluded that the surveillance was performed in accordance with BwVS 1.2.3.1-2 and all acceptance criteria were met, but questioned the validity of the data used to meet that criteria. The inspectors concluded that the ability of the charging pumps to start as they would be required to in the event of an accident

was not being demonstrated since no as-found testing was performed. The inspectors agreed with the licensee that BwVS 1.2.3.1-2 may not be the appropriate procedure to demonstrate the ability of the charging pumps, but the licensee was unable to provide a surveillance procedure that did perform an as-found test.

The inspectors concluded that all active components in each train of the CV pump injection are exercised per procedure BwVS 0.5-2.SI.2-3 prior to the measurement of Trains A and B CV Pump response times resulting in the preconditioning of both trains.

With regard to the examples of the previous paragraphs, the inspectors were concerned that the conditions of a standby component actuated in the event of an accident were not completely tested, and that degradation mechanisms may not be identified during charging pump starting. The inspectors concluded that the surveillances did not demonstrate satisfactory performance of the charging pumps under conditions expected in the event of an accident. The failure to demonstrate this capability was a violation of 10 CFR Part 50, Appendix B, Criteria XI, "Test Control" (50-456/97005-03;50-457/97005-03(DRP)).

M3.2 125 Volt ESF Round Cell Battery Bank and Rack Surveillance (18 Month) Observation

a. Inspection Scope (61726)

The inspectors observed the performance of portions of BwHS 4009-085, "125 Volt ESF Round Cell Battery Bank and Rack Surveillance," Revision 3E1 for the 125 Vdc Battery 211. The inspector reviewed the following documents:

- BwHS 4009-085, "125 Volt ESF Round Cell Battery Bank and Rack Surveillance," Revision 3E1;
- Braidwood UFSAR, Section 8.3.2.1.1, Class 1E 125 Vdc Power System;
- Braidwood TS, Section 3/4.8.2, D.C. Sources;
- IEEE Standard 308-1971, "IEEE Standard Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations;"
- IEEE Standard 450-1975, "IEEE Recommended Practices for Maintenance, Testing, and Replacement of Large Lead Acid Storage Batteries for Generating Stations and Substations;"
- IEEE Standard 450-1980, "IEEE Recommended Practices for Maintenance, Testing, and Replacement of Large Lead Acid Storage Batteries for Generating Stations and Substations;"

- IEEE Standard 450-1987, "IEEE Recommended Practices for Maintenance, Testing, and Replacement of Large Lead Acid Storage Batteries for Generating Stations and Substations."

b. Observations and Findings

On March 20 and 21 the inspectors observed electrical maintenance department (EMD) personnel perform portions of BwHS 4009-085. The inspector verified that all precautions were met, the procedure was adhered to, observed battery cell connection torque checks, and verified that the as-found torque measurements were as required. The inspectors reviewed TS 3/4.8.2 and IEEE 450-1980, interviewed the system engineer and verified that these requirements were properly met.

Following the completion of cell connection torquing, the inspectors observed the measurement of cell-to-cell resistances between 32 of the 58 cells. The inspector observed that all resistance measurements met the acceptance criteria. The inspectors asked if the measurement of cell-to-cell resistances after performing cell connection torquing was measuring the as-found cell-to-cell resistance. The system engineer indicated that IEEE 450-1980 specified the torquing followed by the cell-to-cell resistance measurements. The inspectors reviewed TS 3/4.8.2 and IEEE 450-1980 to verify the system engineer's statement and found the statement to be correct.

The inspectors reviewed TS 3/4.8.2 and the UFSAR and found that BwHS 4009-085 tested and ensured that the technical specification and UFSAR requirements were met.

c. Conclusions

The inspectors concluded that 125 Vdc ESF battery and rack surveillance for Battery 211 was performed in accordance with BwHS 4009-085. The inspectors also concluded that acceptance criteria, technical specification requirements, and the UFSAR requirements were met.

M5 Maintenance Staff Training and Qualification

M5.1 Maintenance Training Observations for the Unit 1 Reactor Coolant System (RCS) Cold Loop Stop Valve Repair

a. Inspection Scope (62703)

The inspectors observed maintenance training conducted on a mock-up of the Unit 1 "C" RCS Cold Loop Stop Valve, 1RC8002C. The inspectors also reviewed work package 960094676-01.

b. Observations and Findings

On March 21 and 25, 1997, inspectors observed training activities in preparation for the repair of 1RC8002C in the upcoming refueling outage AR106. The training was performed on an identical valve. The mock-up was constructed to represent the conditions found in containment.

The inspectors observed training on dose reduction techniques, the detensioning and tensioning of bonnet studs, contamination control, bonnet gasket removal, lifting of the bonnet, examination of gate and valve body seating surfaces, examination of valve internals, and repair of the valve gate guide channels. The inspectors observed a portion of a walk-through of the work package procedure to be used for the actual valve repair. The inspectors observed the detensioning up to and including the gate inspection. The maintenance personnel performed the observed activities with minimal prompting and correction from supervisors and radiation protection personnel. Additional discussion is provided in Section R4.1.

c. Conclusions

The inspectors concluded the following:

- licensee's mock-up, to the extent practical, provided a accurate representation of the conditions that would be encountered by maintenance personnel during the actual repair of 1RC8002C;
- the work package appeared to contain sufficient guidance for the proper performance of work;
- the familiarity gained by maintenance personnel and lessons learned in working with the mock-up should result in reduced exposure during the valve maintenance;
- the training was comprehensive and appeared to be adequate for the work to be performed.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 Failure To Perform 10 CFR 50.59 Safety Evaluation

a. Inspection Scope (37551)

The inspectors expressed a concern about the operability of the auxiliary building exhaust plenum. The inspectors reviewed procedures NSWP-A-04, "10CFR50.59 Safety Evaluation Process," Revision 0; BwAP 330-10, "Operability Assessments,"

Revision 2; and BwAP 1110-3, "Plant Barrier Impairment Program," Revision 3. The inspectors also interviewed the Unit 2 Operating Engineer.

b. Observations and Findings

The inspectors observed on the February 25 Unit 2 Unit Supervisor's turnover sheet that the licensee had hoses running through the door between the auxiliary building and the auxiliary building ventilation exhaust plenum. The note said that the hoses had to be capable of being removed from the doorway within 10 minutes of an accident for the exhaust plenum to have been considered operable.

The inspectors asked the unit operating engineer what the 10-minute operability time was based on and whether an operability evaluation or a 10 CFR 50.59 safety evaluation had been prepared. In addition, the inspectors questioned who was responsible for ensuring the door was to be closed and how that person was to ensure the door would be closed.

Licensee personnel responded that no operability evaluation or 10 CFR 50.59 had been prepared for opening the auxiliary building exhaust plenum door. Blocking open the door was controlled by the use of a PBI. The 10-minute time period came from a calculation that apparently demonstrated that if all safety injection pumps were injecting that the refueling water storage tank would not empty for 11 minutes. Therefore, if the door were closed within 10 minutes the recirculation phase would not yet have started and radioactive contamination of the auxiliary building air from the containment recirculation sump would not have been possible. The licensee stated that the job foreman left his pager number with the unit supervisor and it was the foreman who was responsible for ensuring the door was closed. The evaluation and description of contingency actions to maintain operability were spelled out in the PBI paper work. The PBI did not get the same review as an operability or a safety evaluation. The inspectors also found that this issue did not constitute an unresolved safety question.

NSWP-A-04, Step 4.3.1, defines an abnormal lineup as the "alignment of equipment in a configuration that differs from approved procedures, or the description in the SAR, for the intended operating mode." Step 6.1.2.1 stated in part that a screening or safety evaluation should be performed prior to placing equipment in an abnormal line up unless a previous safety evaluation exists or the line up is described in an approved procedure.

c. Conclusions

The inspectors concluded that blocking open the auxiliary building exhaust plenum door was an abnormal lineup of the auxiliary building ventilation system as defined in NSWP-A-04. The use of the PBI to evaluate and describe contingency actions to maintain operability of the auxiliary building ventilation system was improper. An evaluation for blocking the door open was documented on a plant barrier impairment. A plant barrier impairment was not the correct mechanism to document an evaluation of operability. The inspectors concluded that the failure to

perform a safety evaluation was a violation of 10 CFR 50.59 (b)(1) (50-457/97005-04(DRP)).

E2.2 Operability Evaluations

a. Inspection Scope (37551)

The inspectors reviewed two operability evaluations, 97011 "Improper Orientation of Check Valve 2CS020B" and 97012 "Inadequate Piston Crown Thickness On Cooper Bessemer KSV Diesel Generators."

b. Observations and Findings

The inspectors reviewed the assumptions used and the basis from which a determination of operability was made and had no concerns in either case. The determinations of operability were well thought out and documented in both cases.

c. Conclusions

The inspectors concluded that operability evaluations 97011 and 97012 were good.

E4 Engineering Staff Knowledge and Performance

E4.1 Auxiliary Building Modification Testing

a. Inspection Scope (37551)

The inspectors observed performance of post modification testing on the auxiliary building ventilation system. The inspector reviewed the test procedure and the associated 10 CFR 50.59 safety evaluation. The inspector also interviewed system engineering and radiation protection personnel about the testing.

b. Observations and Findings

On March 4 a post modification test was started to determine the impact of exempt (minor) changes to modifications on the auxiliary building ventilation system. Exempt changes tested in the procedure included:

E20-0-96-301-001	--	Installation of upgraded forged blades in the 0VA02CCVA main exhaust fan.
E20-2-95-262	--	Installation of Unit 2 exhaust plenum inlet ramp.
E20-2-95-260	--	Installation of Unit 2 exhaust plenum turning vanes.

The inspectors reviewed the test procedure and determined that the procedure would adequately test the items that were modified. The 10 CFR 50.59 safety evaluation was completed and all evaluation questions were answered properly.

Prior to performing the test, radiation protection personnel performed surveys of the supply and exhaust plenums with no radioactive contamination detected. They were also available to support the system engineer as necessary.

The ventilation system engineer was the test coordinator for this modification test. The system engineer was knowledgeable of operation of the system, history of the system, scope of modifications being tested, and the actual performance of the test. The system engineer also provided in-depth information on the ventilation system during a tour of the system with the inspector.

During the first 2 hours of the test, engineering and operations personnel monitored system parameters and recorded test data. After 0VA02CC, VA main exhaust fan, was running for approximately 2.5 hours, the inspector and system engineer entered the exhaust plenum area to check operation of the fan. The system engineer discovered that the exhaust fan inboard bearing oiler was empty. Oil level in the oiler was verified prior to starting the fan and the loss of oil indicated a problem.

Upon discovering the empty oiler, the system engineer immediately evacuated all personnel from the plenum area and then called the control room to stop the fan. The fan was stopped immediately and performance of the test procedure was terminated.

The system engineer generated problem identification form (PIF) 456-201-97-0567 to investigate the loss of oil from the bearing. Testing on the bearing included boroscoping the bearing to see if a fault could be identified. No problems with the bearing or the installation of the bearing were identified.

Since the fan bearing was not faulty, engineering personnel evaluated operation of the new fan blades. The evaluation determined that a low pressure area in the fan hub area was created by the new fan blades. This low pressure area caused oil to be pulled out of the bearing. The bearing seal was being modified by the manufacturer to compensate for the new low pressure area outside the bearing.

The licensee planned to continue the modification test when the modified bearing seal was obtained. Plant personnel expected to receive the new bearing seal in April 1997.

c. Conclusions

Engineering support for post modification testing was good. However, a new condition created by the new fan blades installed in 0VA02CC caused a loss of all oil from the fan inboard oiler. This condition was not anticipated when the fan blades were originally modified.

Monitoring of fan operation by the system engineer resulted in timely detection of the oil level depletion. Prompt actions by the engineer prevented potential injury to personnel in the area and also prevented possible damage to plant equipment.

Radiation protection support for the test was prompt and efficient.

IV. PLANT SUPPORT

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 Locked High Radiation Area Posting for Auxiliary Building Floor Drain Tank Pump Room

a. Inspection Scope (71750)

During routine inspection of the auxiliary building on March 18, the inspector noted that a new "Locked High Radiation Area" posting was affixed to the door for the auxiliary building floor drain tank pump room. As a result of the posting, the inspector reviewed procedure BwRP 5310-2, Revision 1, "Control of Access to High Radiation Areas and Very High Radiation Areas." The inspector also interviewed radiation protection personnel about the condition.

b. Observations and Findings

At approximately 6:00 a.m. on March 18 the inspector noted the posting for the auxiliary building floor drain tank pump room as a "Locked High Radiation Area." In addition to the posting, a red flashing light was staged at the room door. Although the posting stated that the area was locked, there was no core in the door locking mechanism. Therefore, the door could not be locked.

The inspectors reviewed procedure BwRP 5310-2 requirements for locked high radiation areas. The procedure allows use of alternate methods of controlling access to areas when locking of the area is not possible. Use of a red flashing light at the entrance is specifically stated in the procedure as an alternate method of controlling access, provided BwRP 5310-2T7, "High Radiation Area Posting and Barrier Deviation Form," is used to document the deviation. The inspector verified that the deviation form was completed and on file in the radiation protection office.

The inspectors interviewed radiation protection (RP) personnel about conditions in the auxiliary building floor drain tank pump room. The RP supervisor on duty stated that the new radiological condition was discovered at about 5:00 a.m. on that day. A new hot spot (approximately 3 Rem/hr at 30 cm) was identified in the room during routine radiological surveys.

The RP supervisor stated that the alternate methods for controlling access were temporary until a core was placed in the locking mechanism for the door. RP personnel expected the core to be installed before noon on March 18, 1997. The

inspector checked the auxiliary building floor drain tank pump room door again at 10:00 a.m. on March 18 and verified that a core was in the locking mechanism and that the door was locked. The red flashing light previously staged at the room was removed.

Operations and RP personnel performed flushing of the line where the hot spot was located and the hot spot was flushed to the auxiliary building floor drain tank on March 20. The tank is located in a separate room from the pumps and the tank room is normally a locked high radiation area. The locked high radiation area posting for the auxiliary building floor drain tank pump room was subsequently removed after RP personnel surveyed the room and verified the posting was no longer required.

c. Conclusions

Prompt appropriate corrective actions were taken by the licensee to reduce dose rates in the auxiliary building floor drain tank pump room shortly after a hot spot was identified during routine surveys. This resulted in a reduced possibility of unnecessary exposure.

R4 Staff Knowledge and Performance in RP&C

R4.1 Job Specific Radiation Protection Training

a. Inspection Scope (71750)

The inspectors reviewed actions taken by radiation protection personnel to minimize exposure of maintenance personnel assigned to the repair of the Unit 1 RCS Cold Loop Stop Valve, 1RC8002C.

b. Observations and Findings

On March 25 the inspectors discussed radiation protection (RP) measures planned in order to minimize the dose to maintenance personnel involved in the repair of 1RC8002C. The radiation protection technician assigned to the valve repair job discussed the following items with the inspectors:

- Incorporation of lessons learned from a similar maintenance evolution,
- RP participation in the mock-up training,
- RWP requirement to perform pre-job briefing prior to beginning work,
- installation of additional shielding,
- use of the WRM-91 system for dose monitoring,

- utilization of cameras with monitors located in low dose areas for routine inspections,

- identification and use of low dose waiting areas,

- contamination controls (water sprays, addition ventilation with HEPA filters, and respirator use during initial breach of the reactor coolant system), and

- contingency plans.

The inspectors observed the use of the cameras and the WRM-91 Remote Dose Monitoring system on the mock-up. The inspectors noted the exceptional clarity and detail provided by the cameras. Additional discussion is in Section M5.1.

c. Conclusion

The inspectors concluded that RP preparations for the 1RC8002C repair were comprehensive and adequate for the work to be performed. The use of cameras and the WRM-91 systems will allow supervision to monitor personnel dose and repair activities from low dose areas.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on April 7, 1997. 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

H. G. Stanley, Site Vice President
*T. Tulon, Station Manager
*A. Haeger, Health Physics and Chemistry Supervisor
*R. Byers, Maintenance Superintendent
*R. Graham, Work Control Superintendent
*T. Simpkin, Regulatory Assurance Supervisor
*C. Dunn, System Engineering Supervisor
*J. Meister, Engineering Manager
*B. Wegner, Operations Manager
M. Cassidy, Regulatory Assurance - NRC Coordinator

NRC

*R. Lanksbury, Chief, Reactor Projects Branch 3
*C. Phillips, Senior Resident Inspector
*J. Adams, Resident Inspector

IDNS

*T. Esper

* Indicates present at April 7 exit meeting.

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62703:	Maintenance Observation
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-456/97005-01; 50-457/97005-01	VIO	failure to properly maintain emergency operating procedures
50-456/97005-02; 50-457/97005-02	VIO	failure to take prompt corrective actions
50-456/97005-03; 50-457/97005-03	VIO	failure to have proper test controls in place
50-456/97005-04; 50-457/97005-04	VIO	failure to write a 10 CFR 50.59 safety evaluation

LIST OF ACRONYMS USED

AR	Action Request
ATWS	Anticipated Transient Without a
ABVA	Auxiliary Building Ventilation System
AFW	Auxiliary Feedwater
CFR	Code of Federal Regulations
CV	Chemical Volume
EMD	Electrical Maintenance Department
EDG	Emergency Diesel Generator
ESF	Engineered Safety Features
FME	Foreign Material Exclusion
HLA	Heightened Level of Awareness
IPA	Infrequent Plant Activity
LCO	Limiting Condition for Operation
NRC	Nuclear Regulatory Commission
NSO	Nuclear Station Operator
PBI	Plant Barrier Impairment
PORV	Power Operated Relief Value
PIF	Problem Identification Form
PDR	Public Document Room
RP	Radiation Protection
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR or RH	Residual Heat Removal
SOS	Shift Operations Supervisor
SQV	Site Quality Verification
TS	Technical Specification
US	Unit Supervisor
UFSAR	Updated Final Safety Analysis Report
VIO	Violation
VCT	Volume Control Tank
WR	Work Request