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Hal B. Tucker
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DUKE POWER

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NC
BCO

October 28, 1988

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Oconee Nuclear Station, Unit 3
Docket No. 50-287
Licensee Event Report 287/88-05

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 287/88-05 concerning a disabled decay heat removal capability due to a loss of AC power on Unit 3. This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(v)(B). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

JW Hampton, for
Hal B. Tucker

SEL/PJN/418/mmf

Attachment

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Mr. P.H. Skinner
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8811040139

11pp

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Group File: OS-815.04

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	1 OF 0 9

TITLE (4) A Unit 3 ALERT Was Declared Due To A Loss Of Power Which Disabled Decay Heat Removal Capability - Management Deficiency

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 9	1 1	8 8	8 8	— 0 0 5 —	0 0	1 0	2 8	8 8	N/A	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	XX 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER	
	AREA CODE	
Steven E. LeRoy, Licensing	7 0 4	3 7 3 - 6 2 3 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On 09/11/88, at 0317, with Unit 3 at cold shutdown, a loss of power occurred on Unit 3 which resulted in a loss of Decay Heat (DH) removal capability. The power loss occurred during the performance of PT/3/A/0610/01H (Emergency Power Switching Logic Stand-By Breaker Closure Channel A & B) when Non-Licensed Operator (NLO) B became confused while racking breakers into the test configuration. Instructions from NLO B's supervisor led NLO B to perform a task which initiated a loss of power resulting in the Main Feeder Busses being deenergized and power to the Low Pressure Injection (LPI) pumps being lost. An ALERT was declared at 0355 and terminated at 0410. At the time of the event, the Reactor Vessel was drained to approximately 15 inches and the LPI System was providing DH removal. Due to current plant conditions, the operators had no way to determine the condition of the core. After approximately 15 minutes, the Stand-By Bus was energized and power was supplied to the LPI pumps. At this time it was determined that core temperature had increased approximately 15 degrees during the event. The corrective actions were to regain power to Unit 3, regain the ability to cool the core, evaluate the condition of the core, add (using a restricted procedure change) steps to tag control room switches and the Control Power Fuses when they were removed by the performance procedure, and to add a recovery method to the Performance procedure. This event is assigned a cause of Management Deficiency due to insufficient verbal instructions and deficient communication.

☆ U.S.GPO:1984-0-454-481/18759

INTRODUCTION:

On September 11, 1988, at 0317, with Unit 3 at cold shutdown, a loss of power occurred on Unit 3 which resulted in a loss of decay heat (DH) removal capability. This power loss occurred during the performance of PT/3/A/0610/01H (Emergency Power Switching Logic Stand-By Breaker Closure Channel A & B) when Non-Licensed Operator (NLO) B became confused while racking breakers into the test configuration. Instructions from NLO B's supervisor led NLO B to perform a task which initiated a loss of power. The loss of power resulted in the Main Feeder Busses being deenergized and power to the Low Pressure Injection (LPI) system [EIIS:BP] pumps was lost. An ALERT was declared due to the "Loss of Functions Needed to Maintain Plant Cold Shutdown" at 0355 and terminated at 0410. At the time of the event, the Reactor [EIIS:RCT] Vessel was drained to approximately 15 inches and the LPI System was providing DH removal. Due to current plant conditions, the operators had no way to determine the condition of the core. After approximately 15 minutes, the Stand-By Bus was energized and power was supplied to the LPI pumps. At this time it was determined that core temperature had been increased approximately 15 degrees during the event. The subsequent corrective actions were to regain power to Unit 3, regain the ability to cool the core, evaluate the condition of the core, add (using a restricted procedure change) steps to tag control room switches and the Control Power Fuses when they were removed by the performance procedure, and to add a recovery method to the Performance procedure. The root cause of the loss of power was Management Deficiency. NLO B became confused while performing the procedure and contacted Unit Supervisor (US) A for instructions. Unit Supervisor A did not access the available information sources to determine the status of the Performance procedure prior to providing NLO B with instructions to install the Control Power Fuses. The communication between US A and NLO B was deficient and contributed to the loss of power. Therefore this event is assigned a cause of Management Deficiency due to insufficient verbal instructions and deficient communication. Contributing causes to this event are deficient communication between US A and Control Room Supervisor (CRS) A, deficient communication between CRS A and the Nuclear Control Operators (NCO), deficient communication between the NCO and NLO B, and CRS A not marking "Not Applicable" the appropriate steps in the R&R prior to it being used in conjunction with the test procedure. During the investigation of this event, there were some deficiencies noted. The decision to perform the test with a minimum coolant level in the Reactor Vessel was a questionable decision due to the fact that only one power source was available to supply the MFB. This decision did not affect the occurrence of the event; however, it did increase the consequences. Another deficiency was the absence of maintenance tags on the Control Power Fuses in the blockhouse. The addition of the tags would have provided another barrier to prevent the event from occurring.

EVALUATION:

Background

There are two Assistant Shift Supervisors, which hold a Senior Reactor Operator License (SRO), assigned to each Unit during each shift. One of the Assistant Shift Supervisors is assigned as the Unit Supervisor (US). It is his duty to supervise the overall unit activities and to coordinate interface with other groups. The other Assistant Shift Supervisor is designated as the Control Room Supervisor (CRS). It is his duty to oversee the control room activities and to provide guidance and leadership to the shift personnel. It is required that the CRS be in the control room when the unit is above cold shutdown. The Control Room Operators (CRO) are responsible for monitoring the control room instrumentation and operating the plant. The CROs are also responsible for providing guidance to the Non-Licensed Operators (NLO). The CRO can provide the NLO with their work assignments and assist in handling any field problems which the NLO encounters. It is the duty of all of the above individuals to ensure that all prerequisite conditions and requirements for procedures being performed on the unit be met. It is also the responsibility of the CRS and US to mark Not Applicable (N/A) any steps in a procedure which are not required for the proper performance and completion of the procedure. It is acceptable for them to mark N/A steps which are determined to be N/A after the procedure has been started, however any steps which are known to be N/A prior to the start of the procedure should be marked as such before starting the procedure.

It is the responsibility of the Performance group to conduct periodic functional testing of certain plant systems. It is also their responsibility to provide written procedures for any functional testing or surveillance which they are performing. These procedures must include any prerequisite conditions or requirements that must be met prior to performing the test or surveillance.

The Oconee Emergency Power Switching Logic, in conjunction with its associated circuits, provides a means for assuring that power is supplied to the unit Main Feeder Buses and; hence, to the unit's essential loads under accident conditions. The logic system monitors the normal and emergency power sources; and, upon loss of the normal power source (the unit auxiliary transformer), the logic will seek an alternate source of power.

Description of Event

On September 10, 1988, Performance procedure PT/3/A/0610/01H (Emergency Power Switching Logic Stand-By Breaker Closure Channel A & B) was started on Unit 3. This procedure tests the circuitry for the Emergency Power Switching Logic. On September 10, Operations Control Room Supervisor (CRS) A was also briefed by Performance Test Supervisor A about PT/3/A/0610/01H. The briefing was held to ensure that the Operations and Performance interface would be smooth.

It was CRS A's decision that the Non-Licensed Operator (NLO) assigned to assist the Performance personnel would also use Enclosure 3.3 of OP/0/A/1102/06 (Procedure for Removing From or Returning to Service 6900/4160/600 Volt Breakers) (R&R) in conjunction with PT/3/A/0610/01H. This decision was made since the breaker checklist, which ensures that groups of breakers are properly aligned, had already been completed for start-up of the unit and CRS A wanted to ensure that the breakers would be properly returned to service.

After this briefing, CRS A assigned NLO A to assist Performance with the procedure. He informed NLO A of his decision to use the R&R in conjunction with the Performance procedure and gave a full explanation of the job expected of NLO A. He instructed NLO A to call the control room with any questions that should arise during the job performance. Also he did not review the R&R and mark N/A appropriate steps. NLO A then left with the Performance personnel to perform the necessary breaker racking required to achieve the test configuration. At this point, CRS A told Unit Supervisor (US) A and Control Room Operator (CRO) A that a Performance electrical test was being performed. He did not inform CRO A or US A that he had instructed NLO A to use an R&R in conjunction with PT/3/A/0610/01H, nor did he provide them with specific details about the test.

During the breaker racking, NLO A was confused when PT/3/A/0610/01H required that a breaker be racked in and the Control Power Fuses be left out of the breaker. He called CRS A and informed him that the R&R and the Performance procedure were in disagreement concerning this step. CRS A went to the blockhouse to compare PT/3/A/0610/01H and the R&R. Upon arriving at the blockhouse, CRS A reviewed both procedures and talked to the Performance technician concerning the reason the Control Power Fuses would be left un-installed. He was informed that the Control Power Fuses were removed to prevent the breaker tripping during the test. After this discussion, CRS A told NLO A to leave the Control Power Fuses un-installed since this was to prevent the breaker from responding to trip signals which would be initiated during the test. CRS A did not mark N/A the step in the R&R which called for the fuses to be installed at this time.

Later during the shift, US A and CRS A were called away from Unit 3 to attend an Operations meeting at the Unit 1&2 Supervisors office. It was not a requirement that there be a Senior Reactor Operator in the control room with the unit at cold shutdown. Upon completing the breaker configurations required for the Channel A section of PT/3/A/0610/01H, NLO A was reassigned to a job in the Reactor Building. At approximately 0200 on September 11, 1988, the Channel A test was completed and CRO A assigned NLO B to assist Performance personnel with the breaker configurations required for the Channel B test. NLO B went with the Performance personnel and put the breakers into the configuration for the Channel B test. Upon returning to the control room, NLO B was informed by another operator that NLO A had been using an R&R as instructed by CRS A. NLO B got the R&R which had been used previously and returned to the blockhouse to ensure that the breaker had been properly returned to service. Upon comparing the R&R to the breaker as left

condition, NLO B found that he had not reinstalled the Control Power Fuses when using PT/3/A/0610/01H. He became confused and called US A for guidance. US A had returned from the meeting although CRS A had not returned. NLO B incorrectly led US A to believe that testing was complete for breaker 3B1T-1 and told him that PT/3/A/0610/01H did not have the Control Power Fuses reinstalled while the R&R required the reinstallation of the Control Power Fuses. At 0317, US A instructed NLO B to reinstall the Control Power Fuses into the breaker. Upon the installation of the Control Power Fuses, breaker 3B1T-1 tripped and a loss of power occurred on Unit 3. None of the alternate power supplies could be transferred due to the test equipment connection and the test configuration of the breakers. At the time of the trip, decay heat removal was being accomplished through the Low Pressure Injection (LPI) system. Upon the loss of power, the LPI pumps were deenergized and Decay heat removal capability was lost. Since the Incore thermocouples had not been reconnected and the loss of power caused a failure of Reactor Vessel Level Transmitter 5 [EIIS:TIT], there were no available core indications to determine the condition of the core. Even though the Reactor Protective system [EIIS:JC] indications are battery backed up, these indications come from hot leg and cold leg RTDs which were not available due to the system being open and due to ongoing outage work. The first method used to attempt to restore power was to open the standby breakers and try to close in breaker 3B1T-1 from the start-up source. This method was attempted due to the thought that breaker 3B1T-1 had tripped due to the standby breakers being in the closed position. What actually caused breaker 3B1T-1 to trip was a trip signal, from a Variac, in the performance test being input into the breaker trip logic at the time the Control Power Fuses were reinstalled. When the loss of power occurred, the Variac lost power and the start-up breaker would not close due to sensing no voltage on the start-up bus. Operations then racked the standby bus breakers into the closed position and energized the standby bus through these breakers. When the standby bus was energized at 0332, the loss of power was terminated and the LPI pumps were restarted. When the LPI pumps were restarted, decay heat removal capability was again established. The condition of the core was evaluated and the core temperature was found to have risen approximately 15 degrees to approximately 105 degrees-F. At 0355, an ALERT was declared on Unit 3 due to the "Loss of Functions to Maintain Plant Cold Shutdown" which occurred during the loss of power from 0317 to 0332. The ALERT was terminated at 0410.

CONCLUSION

It is concluded that the root cause of this loss of power event was Unit Supervisor (US) A giving verbal instructions to Non-Licensed Operator (NLO) B without fully apprising the situation. Unit Supervisor A had Performance personnel available in the control room who could have been consulted to determine the status of the test and the condition which the Control Power Fuses should have been in at that time. Also, US A could have either gone to the blockhouse and reviewed the Performance procedure in conjunction with the Operations procedure, or instructed NLO B to return to the control room where the confusion of the

situation could have been rectified. Unit Supervisor A could also have consulted Control Room Supervisor A to find out the test requirements. Unit Supervisor A was not fully aware of the Performance procedure when he made his decision. Due to the insufficient verbal instructions of US A to NLO B, this event has been assigned a cause of Management Deficiency due to insufficient verbal instructions and deficient communication.

There were two contributing causes to this event. The first contributing cause is the lack of communication between CRS A, US A and the Control Room Operators (CRO). CRS A was briefed by Performance about the test and was contacted by NLO A regarding the Control Power Fuses not being reinstalled. CRS A also made the original decision to use the Operations procedure in conjunction with the Performance procedure. Once CRS A had received the briefing from the Performance personnel, it was his responsibility to provide US A and the CROs with enough information to enable them to adequately supervise any Operations personnel involved with the test. Unit Supervisor A was aware only that a Performance electrical test was being performed but was not aware of the scope of the test.

The CROs were also not aware of the scope of the job and were not aware that CRS A had decided to use the Operations procedure in conjunction with the Performance procedure. Since the CROs did not know about the use of both procedures, they did not inform NLO B to use the Operations procedure. These facts combine to show that the amount of pre-job communication between the control room personnel was inadequate.

The second contributing cause of this event was the failure of CRS A to mark Not Applicable (N/A) the appropriate steps in the Operations procedure prior to its field use. Since it was his decision to use the Operations procedure, it was also his responsibility to mark N/A the appropriate steps in the procedure. Since he had been involved in the briefing and was the cognizant Operations person on the test, and since he was also involved with NLO A when he expressed confusion over the Control Power Fuses during set up of the Channel A test, he should have marked the steps N/A as appropriate.

The following deficiencies were also found. The Control Power Fuses and the control room switches were not tagged by the Performance procedure. If these items had been tagged, it would have provided an additional barrier to possibly prevent this event. There was also a deficiency in the decision by Operations and Integrated Scheduling to allow the performance of this test with the vessel drained to approximately 15 inches. This condition put the plant into a situation where it was most susceptible to loss of decay heat capability and was relying on a single power source for the Main Feeder Buses. The questionability of this decision was emphasized by recent NRC concerns regarding loss of residual heat capability.

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Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	8 8	— 0 0 5	— 0 0	0 7 OF 0 9

TEXT (If more space is required, use additional NRC Form 366A's) (17)

A review of Oconee Licensee Event Reports for the last three years shows that a similar event has not occurred; therefore, this incident is not a recurring event.

This event is not reportable to the Nuclear Plant Reliability System (NPRDS) since there was no component failure/malfunction involved.

No radioactive material releases, personnel overexposures or personnel injuries occurred as a result of this event.

CORRECTIVE ACTIONS:

Immediate:

1) AC Power was regained to Unit 3.

2) Decay heat removal capability was regained.

3) The core conditions were evaluated to ensure that no damage had occurred.

Supplemental:

1) A restricted change was added to PT/3/A/0610/01H to tag the Control Power Fuses, control room switches, and add a power recovery method. This restricted change was effective through End of Cycle 10 on Unit 3.

Planned:

1) Operations will have Staff and Shift personnel read and review this report to emphasize the importance of communication and pre-job planning. Communication between all levels of Control Room Management and the importance of marking Not Applicable (N/A) steps in procedures prior to field use will be stressed.

2) Operations will establish guidelines for operating during drained conditions to specify a minimum level in the Reactor Vessel prior to the performance of PT/3/A/0610/01H, and this guideline will be added to the prerequisites of the procedure.

3) Performance and Operations will revise PT/3/A/0610/01H and review other applicable procedures to ensure that there are adequate steps for breaker racking.

4) Performance will implement a permanent procedure change to PT/3/A/0610/01H which will tag the Control Power Fuses with a Temporary Modification Blue Tag, and will tag Control Room switches with a White Tag.

5) Operations and Integrated Scheduling will have personnel review this report and emphasize the need to schedule performance tests during optimum times during the outage.

SAFETY ANALYSIS:

At the time of this event Unit 3 had completed the refueling of the core, the Reactor Vessel head was in place but not bolted, the Reactor Coolant (RCS) system [EIIS:AB] was depressurized, and RCS loops were drained to approximately 15 inches above loop center line. One Low Pressure Injection (LPI) pump was operating for decay heat removal maintaining core coolant temperature at approximately 90 degrees-F. The Reactor Building equipment hatch was open; therefore, containment was not closed at the time of the event. The reactor status was approximately 32 days after shutdown. When power was lost to the LPI pumps, decay heat removal was lost. The loss of all AC power with the RCS system in the condition stated above has two key safety related implications:

1) Potential fuel damage in the core, as a result of the loss of decay heat removal, causing a potential for release to the environment; and,

2) Potential fuel damage in the spent fuel pool, as a result of the loss of spent fuel cooling, causing a potential for release to the environment.

In the Duke Power Company response to Generic Letter 87-12, the worst case scenario was analyzed for loss of decay heat removal while the RCS is depressurized. In this scenario, the RCS is depressurized and drained to 10 inches above the loop center line elevation, the temperature initially at 100 degrees-F, and the refueling canal drained. With the loss of decay heat removal occurring 72 hours after shutdown, the core uncovering is conservatively predicted to occur at 2 hours and 41 minutes.

The subject event was analyzed using actual plant conditions for the consequences of a prolonged loss of decay heat removal. The water in the vessel is expected to reach saturation 125 minutes after the loss of decay heat removal. Subsequent boiling would lead to core uncovering 10 hours after saturation occurs.

For both situations described above, it can be concluded that operating personnel would have ample time to restore power to one LPI pump and to establish containment closure.

It should be noted that 2 independent AC power sources (transformer CT-3 and CT-5) were available at all times and that a closure of any 1 of 4 breakers was sufficient to restore power and thereby restore decay heat removal capability. Operations restored power within 15 minutes.

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Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	8 8	— 0 0 5	— 0 0	0 9 OF 0 9

TEXT (If more space is required, use additional NRC Form 366A's) (17)

The impact of this event on fuel integrity in the spent fuel pool of Unit 3 is bounded by an analysis described in Oconee FSAR Section 9.1.3.3.2. This analysis assumed a complete loss of coolant circulation to the spent fuel pool. The analysis shows that natural circulation flow within the storage tubes ensures that the peak clad surface temperatures remain below 650 degrees-F, which is an acceptable condition.

In conclusion, the loss of AC power for 15 minutes did not significantly increase the risk of fuel damage or a release of radioactivity to the environment. It is concluded that the health and safety of the public were not affected as a result of this event.

R.C.Futrell	P.Abraham	R. Glover	Investigator	H.Lowery	R.P.Bugert	P.Skinner-Reportabl
N.Rutherford	P.F.Guill	R.O. Sharpe	R. Henderson	B&W	OPS(3)	G. Lareau -Trips

Form 3.373 (3-86)

COMPLETE FORM BY PRINTING WITH BLACK BALL POINT PEN OR TYPE

DUKE POWER COMPANY
NUCLEAR STATION

Problem Investigation Report Serial No. 3-088-0203
Station Oconee
Investigation Report No. 088-25-3

I. Problem Occurred-Time/Date: 9-11-88 0317 Discovered-Time/Date: 9-11-88 0317
Units(s): THREE Unit Status At Time Problem Occurred/Discovered: ~~Cold Shutdown~~ REFUELING SD DRAINED TO 15" LT-5
Description of Problem: WHILE PERFORMING PT/3/A/610/01H EPSL STANDBY BKR CLOSURE CHANNEL A & B, UNIT 3 SUFFERED A LOSS OF ALL AC POWER. THIS INCLUDED LPI AND LPSW WHICH WERE COOLING THE RX CORE. POWER WAS REGAINED AFTER ≈ 15 MINUTES. AN ALERT WAS DECLARED DUE TO "LOSS OF FUNCTIONS NEEDED TO MAINTAIN PLANT COLD SHUTDOWN."

Location of Problem: UNIT 3
Method Used to Identify Problem: LOSS OF POWER / EMERGENCY LIGHTS CAME ON
Immediate Corrective Actions Taken/To Be Taken: RESTORED POWER BY RACKING IN AND CLOSING THE STANDB BKRS INVESTIGATION IN PROGRESS

Work Stoppage Notification (Form QCK-2A) Written ☐ Yes ☐ No: Serial No.
Information Sources/References (Work Requests, Document Violated, etc.): PT/3/A/0610/01H OP/0/A/1102/06 Enc. SHIFT INCIDENT REPORT
Originated By: Scott Hollingsworth Date: 9-13-88 Dept./Group/Section NPD OCONEE OPS

II. ~~Compliance Evaluation~~ Item/System Operable ☑ Yes ☐ No
Item Reportable ☑ Yes ☐ No Reportable Pursuant To: ☑ 50.73 Section (a)(2)(v)(B)
☑ 50.72 Section (a)(1)(v) T.S. Section ☐ Lic. Cond. Section ☐ Part 21
☐ Other Evaluated By/Date: [illegible] 9/14/88
Comments:

III. Telecon/ENS Report to NRC Time/Date: 0400 9-11-88
NRC Contactee(s): Reckley DPC Contactor(s): C. Sheridan
Telegraph/Mailgram/Facsimile Transmission to NRC-Date:
Date Notified: NRC Res. Inspector 9-11-88 Station Manager 9-11-88
General Office Comments:

IV. Incident Investigation Report Assigned To: OSRG NRC Report Due Date: 10-11-88
Date Due to Compliance after Evaluation 10-5-88
PIR Review (Compliance): [illegible] Date: 10-11-88
PIR Station Manager Approval M. S. Tuckman Date: 10/7/88

V. Further Action/Evaluation Required ☐ Yes ☑ No (Explain Below):
Page 2 Assigned To:
Comments: All commitments complete - Rom 9/18/90

Compliance Review Rick Matheson Date 9/20/90 QA Review [illegible] Date 9-19-90
Trend Code (QA)

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LER 287/88-05

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

IIR 088-25-3

AN ALERT WAS DECLARED ON UNIT, 3 DUE TO LOSS OF POWER WHICH DISABLED DECAY HEAT REMOVAL CAPABILITY RESULTING, FROM A MANAGEMENT DEFICIENCY

1.0 INTRODUCTION

On September 11, 1988, at 0317 hours, with Unit 3 at cold shutdown, a loss of power occurred on Unit 3 which resulted in a loss of Decay Heat (DH) removal capability. This power loss occurred during the performance of PT/3/A/0610/01H (Emergency Power Switching Logic Stand-By Breaker Closure Channel A & B) when Non-Licensed Operator (NLO) "B" became confused while racking breakers into the test configuration. Instructions from NLO "B"s supervisor led NLO "B" to perform a task which initiated a loss of power. The loss of power resulted in the Main Feeder Busses being deenergized and power to the Low Pressure Injection (LPI) pumps was lost. An ALERT was declared due to the "Loss of Functions Needed to Maintain Plant Cold Shutdown" at 0355 hours and terminated at 0410 hours.

At the time of the loss of power, the Reactor Vessel was drained to approximately fifteen (15) inches and the LPI System was providing DH removal. Due to current plant conditions, the operators had no way to determine the condition of the core. After approximately fifteen (15) minutes, the Stand-By Bus was energized and power was supplied to the LPI pumps. At this time it was determined that core temperature had been increased approximately 15 degrees during the incident.

The subsequent corrective actions were to regain power to Unit 3; regain the ability to cool the core; evaluate the condition of the core; add, using a restricted procedure change, steps to tag control room switches and the Control Power Fuses when they were removed by the performance procedure; and to add a recovery method to the Performance procedure.

The root cause of the loss of power was Management Deficiency. NLO "B" became confused while performing the procedure and contacted Unit Supervisor (US) "A" for instructions. US "A" did not access the available information sources to determine the status of the Performance procedure prior to providing NLO "B" with instructions to install the Control Power Fuses. The communication between US "A" and NLO "B" was deficient and contributed to the loss of power. Therefore this event is classified by Event Cause Code E, Management Deficiency, Insufficient Verbal Instructions and Deficient Communication. Contributing causes to this incident are deficient communication between US "A" and Control Room Supervisor (CRS) "A", deficient communication between CRS "A" and the Nuclear Control Operators (NCO), deficient communication between the NCO and NLO "B", and CRS "A" not marking "Not Applicable" the appropriate steps in the R&R prior to it being used in conjunction with the test procedure.

During the investigation of this incident, there were some deficiencies noted. The decision to perform the test with a minimum coolant level in the Reactor Vessel was a questionable decision due to the fact that only one power source was available to supply the MFB. This decision did not affect the occurrence of the incident, however it did increase the consequences. Another deficiency was the absence of maintenance tags on the Control Power Fuses in the blockhouse. The addition of the tags would have provided another barrier to prevent the incident.

2.0 SEQUENCE OF EVENTS

September 10, 1988

- PT/3/A/0610/01H (Emergency Power Switching Logic Stand-By Breaker Closure Channel A & B) started on Unit 3.

≈1830• Control Room Supervisor (CRS) "A" briefed by Performance Test Supervisor "A".

≈1900• CRS "A" gave permission to start PT/3/A/0610/01H.

- CRS "A" gave Non-Licensed Operator (NLO) "A" instructions to use Enclosure 3.3 of OP/0/A/1102/06 (Removal and Restoration) (R&R) to ensure proper breaker operation.

≈1920• CRS "A" notified Unit Supervisor (US) "A" that PT/3/A/0610/01H being performed.

≈2000• NLO "A" contacted CRS "A" with questions about Control Power Fuses .

September 10, 1988

- CRS "A" consulted Performance personnel.
- CRS "A" informed NLO "A" to leave Control Power Fuses out of breakers per PT/3/A/0610/01H.

≈2200• NLO "A" reassigned to another job in the Reactor Building.

September 11

0100 • CRS "A" and US "A" leave the control room to attend a meeting.

≈0200• Channel "A" of PT/3/A/0610/01H was completed.

- NLO "B" assigned to assist performance with PT/3/A/0610/01H.

0220 • NLO "B" racked 3B1T-1 in with Control Power Fuses out as instructed in PT/3/A/0610/01H.

≈0230• NLO "B" was told that R&R used in conjunction with PT/3/A/0610/01H.

• NLO "B" had US "A" N/A appropriate steps.

• NLO "B" returned to blockhouse to ensure compliance with the R&R.

≈0315• NLO "B" contacted US "A" with questions about Control Power Fuses.

• NLO "B" was confused by discrepancy between PT/3/A/0610/01H and R&R on the placement of the Control Power Fuses.

September 11, 1988

-0315• NLO "B" led US "A" to believe that testing on 3B1T-1 was complete.

0317 • US "A" told NLO "B" to replace the Control Power Fuses into the breaker.

• A loss of power occurred on unit 3.

• The Low Pressure Injection (LPI) pumps were deenergized.

≈0327• An attempt to provide power through the Start-Up bus failed.

0332 • Power was supplied to the unit through the Stand-By Bus.

• The LPI pumps were restarted restoring Decay Heat removal capability.

0355 • An ALERT was declared on Unit 3 due to the "Loss of Functions Needed to Maintain Plant Cold Shutdown".

0410 • The ALERT was terminated.

3.0 EVALUATION

3.1 Background

There are two Assistant Shift Supervisors who each hold a Senior Reactor Operator License (SRO) assigned to each Unit during each shift. One of the Assistant Shift Supervisors is assigned as the Unit Supervisor (US). It is his duty to supervise the overall unit activities and to coordinate interface with other groups. The other Assistant Shift Supervisor is designated as the Control Room Supervisor (CRS). It is his duty to oversee the control room activities and to provide guidance and leadership to the shift personnel. It is required that the CRS be in the control room when the unit is above cold shutdown. The Control Room Operators (CRO) are responsible for monitoring the control room instrumentation and operating the plant. The CRO's are also responsible for providing guidance to the Non-Licensed Operators (NLO). The CRO can provide the NLO with their work assignments and assist in handling any field problems which the NLO encounters. It is the duty of all of the above individuals to ensure that all prerequisite conditions and requirements for procedures being performed on the unit be met. It is also the responsibility of the CRS and US to mark Not Applicable (N/A) any steps in a procedure which are not required for the proper performance and completion of the procedure. It is acceptable for them to N/A steps which are determined to be N/A after the procedure is begun, however any steps which are known to be N/A prior to the start of the procedure should be marked as such before starting the procedure.

It is the responsibility of the Performance group to conduct periodic functional testing of certain plant systems. These personnel must work under the auspices of the Operations Unit and Control Room Supervisors.

It is also their responsibility to provide written procedures for any functional testing or surveillance which they are performing. These procedures must include any prerequisite conditions or requirement that must be met prior to performing the test or surveillance.

The Oconee Emergency Power Switching Logic, in conjunction with its associated circuits, provides a means for assuring that power is supplied to the unit Main Feeder Buses and, hence, to the unit's essential loads under accident conditions. The logic system monitors the normal and emergency power sources; and, upon loss of the normal power source (the unit auxiliary transformer), the logic will seek an alternate source of power.

3.2 Description of Incident

On September 10. 1988, Performance procedure PT/3/A/0610/01H (Emergency Power Switching Logic Stand-By Breaker Closure Channel A & B) was started on Unit 3. This procedure tests the circuitry for the Emergency Power Switching Logic. On September 10, Operations Control Room Supervisor (CRS) "A" was briefed by Performance Test Supervisor "A" about PT/3/A/0610/01H. The briefing was held to ensure that the Operations and Performance interface would be smooth.

It was CRS "A" decision that the Non-Licensed Operator (NLO) assigned to assist the Performance personnel would also use Enclosure 3.3 of OP/0/A/1102/06 (Procedure for Removing From or Returning to Service 6900/4160/600 Volt Breakers) (R&R) in conjunction with PT/3/A/0610/01H. This decision was made since the breaker checklist , which ensures that groups of breakers are properly aligned, had already been completed for startup of the unit and CRS "A" wanted to ensure that the breakers would be properly returned to service.

After this briefing, CRS "A" assigned NLO "A" to assist Performance with the procedure. He informed NLO "A" of his decision to use the R&R in conjunction with the Performance procedure and gave a full explanation of the job expected of NLO "A". He instructed NLO "A" to call the control room with any questions which arose during the job performance. Also he did not review the R&R and N/A appropriate steps. NLO "A" then left with the Performance personnel to perform the necessary breaker racking required to achieve the test configuration. At this point CRS "A" told Unit Supervisor (US) "A" and Control Room Operator (CRO) "A" that a Performance electrical test was being performed. He did not inform CRO "A" or US "A" that he had instructed NLO "A" to use an R&R in conjunction with PT/3/A/0610/01H nor did he provide them with specific details about the test.

During the breaker racking, NLO "A" was confused when PT/3/A/0610/01H required that a breaker be racked in and the Control Power Fuses be left out of the breaker. He called CRS "A" and informed him that the R&R and the Performance procedure were in disagreement over this step. CRS "A" went to the blockhouse to compare PT/3/A/0610/01H and the R&R. Upon arriving at the blockhouse, CRS "A" reviewed both procedures and talked to the Performance technician concerning the reason that the Control Power Fuses would be left uninstalled. He was informed that the Control Power Fuses were removed to prevent the breaker tripping during the test. After this discussion, CRS "A" told NLO "A" to leave the Control Power Fuses uninstalled since this was to prevent the breaker from responding to trip signals which would be initiated during the test. CRS "A" did not N/A the step in the R&R which called for the fuses to be installed at this time.

Later during the shift, US "A" and CRS "A" were called away from Unit 3 to attend an Operations meeting at the Unit 1&2 Supervisors office. It was not a requirement that there be a Senior Reactor Operator in the control room with the unit at cold shutdown. Upon completing the breaker configurations required for the Channel A section of PT/3/A/0610/01H, NLO "A" was reassigned to a job in the Reactor Building. At approximately 0200 hours on September 11, 1988, the Channel A test was completed and CRO "A" assigned NLO "B" to assist Performance personnel with the breaker configurations required for the Channel B test. NLO "B" went with the Performance personnel and put the breakers into the configuration for the Channel B test. Upon returning to the control room, NLO "B" was informed by another operator that NLO "A" had been using an R&R as instructed by CRS "A". NLO "B" got the R&R which had been used previously and returned to the blockhouse to ensure that the breaker had been properly returned to service. Upon comparing the R&R to the breaker as left condition, NLO "B" found that he had not reinstalled the Control Power Fuses when using PT/3/A/0610/01H. He became confused and called US "A" for guidance. US "A" had returned from the meeting although CRS "A" had not returned. NLO "B" incorrectly led US "A" to believe that testing was complete for breaker 3B1T-1 and told him that PT/3/A/0610/01H did not have the Control Power Fuses reinstalled while the R&R required the reinstallation of the Control Power Fuses. At 0317 hours, US "A" instructed NLO "B" to reinstall the Control Power Fuses into the breaker. Upon the installation of the Control Power Fuses, 3B1T-1 tripped and a loss of power occurred on Unit 3. None of the alternate power supplies could be transferred to due to the test equipment connection and the test configuration of the breakers. At the time of the trip, Decay Heat removal was being accomplished through

the Low Pressure Injection (LPI) System. Upon the loss of power, the LPI pumps were deenergized and Decay Heat removal capability was lost. Since the Incore Thermocouples had not been reconnected and the loss of power caused a failure of Reactor Vessel Level Transmitter 5, there were no available core indications to determine the condition of the core. Even though the Reactor Protective System indications are battery backed up, these indications come from hot leg and cold leg RTD's which were not available due to the system being open and ongoing outage work.

The first method used to attempt to restore power was to open the standby breakers and try to close in 3B1T-1 from the start-up source. This method was attempted due to the thought that 3B1T-1 had tripped due to the standby breakers being in the closed position. What actually caused 3B1T-1 to trip, was a trip signal from a variac in the performance test being input into the breaker trip logic at the time the Control Power Fuses were reinstalled. When the loss of power occurred, the variac lost power and the startup breaker would not close in due to sensing no voltage on the startup bus. Operations then racked the standby bus breakers into the closed position and energized the standby bus through these breakers. When the standby bus was energized at 0332 hours, the loss of power was terminated and the LPI pumps were restarted. When the LPI pumps were restarted, decay heat removal capability was again established. The condition of the core was evaluated and the core temperature was found to have risen approximately 15 degrees to approximately 105 degrees Fahrenheit. At 0355 hours, an ALERT was declared on Unit 3 due to the "Loss of Functions to Maintain Plant Cold Shutdown" which occurred during the loss of power from 0317 hours to 0332 hours. The ALERT was terminated at 0410 hours.

3.3 CONCLUSION

It is concluded that the root cause of this loss of power was Unit Supervisor (US) "A" giving verbal instructions to Non-Licensed Operator (NLO) "B" without fully apprising the situation. US "A" had Performance personnel available in the control room who could have been consulted to determine the status of the test and the condition which the Control Power Fuses should have been in at that time. Also US "A" could have either gone to the blockhouse and reviewed the Performance procedure in conjunction with the Operations procedure, or instructed NLO "B" to return to the control room where the confusion of the situation could have been rectified. US "A" could also have consulted Control Room Supervisor "A" to find out the test requirements. US "A" was not fully aware of the Performance procedure when he made his decision. Due to the insufficient verbal instructions of US "A" to NLO "B", this incident is classified by Event Cause Code E, Management/ Quality Assurance Deficiency, Insufficient Verbal Instructions and Deficient Communication.

There were two contributing causes to this incident. The first contributing cause is the lack of communication between CRS "A", US "A" and the Control Room Operators (CRO). CRS "A" was briefed by Performance about the test and was contacted by NLO "A" regarding the Control Power Fuses not being reinstalled. CRS "A" also made the original decision to use the Operations procedure in conjunction with the Performance procedure. Once CRS "A" had received the briefing from the Performance personnel, it was his responsibility to provide US "A" and the CRO with enough information to enable them to adequately supervise any Operations personnel involved with the test. US "A" was aware only that a Performance electrical test was being performed but was not aware of the

scope of the test. The CRO were also not aware of the scope of the job and were not aware that CRS "A" had decided to use the Operations procedure in conjunction with the Performance procedure. Since the CRO did not know about the use of both procedures, they did not inform NLO "B" to use the Operations procedure. These combine to show that the amount of per-job communication between the control room personnel was inadequate.

The second contributing cause of this incident was the failure of CRS "A" to mark Not Applicable (N/A) the appropriate steps in the Operations procedure prior to its field use. Since it was his decision to use the Operations procedure, it was also his responsibility to N/A the appropriate steps in the procedure. Since he had been involved in the briefing and was the cognizant Operations person on the test, and since he was also involved with NLO "A when he expressed confusion over the Control Power Fuses during set up of the Channel A test, he should have N/A'ed the steps as appropriate.

The following deficiencies were also found. The Control Power Fuses and the control room switches were not tagged by the Performance procedure. If these items had been tagged, this would have provided an additional barrier to possibly prevent this incident. There was also a deficiency in the decision by Operations and Integrated Scheduling to allow the performance of this test with the vessel drained to approximately 15 inches. This put the plant into a situation where it was most susceptible to loss of Decay Heat capability and was relying on a single power source for the Main Feeder Buses. The questionability of this decision was emphasized by recent Nuclear Regulatory Commission concerns on Loss of Residual Heat capability.

A review of the last three years shows that a similar incident has not occurred, therefore this incident is not listed as a recurring event. It is also not NPRDS reportable since there was no Component Failure/ Malfunction involved. No radioactive material releases, radiation exposures or personnel injuries occurred as a result of this incident; therefore, the health and safety of the public were not compromised.

4.0 CORRECTIVE ACTIONS

4.1 Immediate

4.1.1 AC Power was regained to Unit 3.

4.1.2 Decay Heat removal capability was regained.

4.1.3 The core conditions were evaluated to ensure that no damage had occurred.

4.2 Supplemental

4.2.1 A restricted change was added to PT/3/A/0610/01H to tag the Control Power Fuses, control room switches, and add a power recovery method. This restricted change was effective through End of Cycle 10 on Unit 3.

4.3 Planned

4.3.1 Operations will have Staff and Shift personnel read and review this report to emphasize the importance of communication and pre-job planning. Communication between all levels of Control Room Management and the importance of marking Not Applicable (N/A) steps in procedures prior to field use will be stressed.

4.3.2 Operations will establish guidelines for operating during drained conditions to specify a minimum level in the Reactor Vessel prior to PT/3/A/0610/01H performance and this will be added to the prerequisites of the procedure.

4.3.3 Performance and Operations will revise PT/3/A/0610/01H and review other applicable procedures to ensure that there are adequate steps for breaker racking.

4.3.4 Performance will implement a permanent procedure change to PT/3/A/0610/01H which will tag the Control Power Fuses with a Temporary Modification Blue Tag and Control Room switches will be tagged with a White Tag.

4.3.5 Operations and Integrated Scheduling will have personnel review this report and emphasize the need to schedule test performance during optimum times during the outage.

5.0 VERIFICATION

No component failure was involved in this incident. Therefore no verification of corrective action is required in this report.

6.0 SAFETY ANALYSIS

At the time of this incident, Unit 3 had completed the refueling of the core, the Reactor Vessel head was in place but not bolted, Reactor Coolant System (RCS) was depressurized, and RCS loops were drained to approximately fifteen (15) inches above loop centerline. One Low Pressure Injection (LPI) pump was operating for Decay Heat removal maintaining core coolant temperature at approximately ninety (90) degrees Fahrenheit. The Reactor Building Equipment Hatch was open thus preventing the establishment of containment integrity. The reactor was approximately 32 days after shutdown.

Oconee Final Safety Analysis Report, Chapter 15, analyzes a station blackout accident with natural circulation through the core and heat removal through the steam generators. The current incident was outside this analysis in that the RCS was drained. Natural circulation was not

possible and heat removal through the steam generators was not available. Loss of power to the LPI pumps interrupted the Decay Heat removal. Two key safety related implications of the loss of all AC power incident are as follows:

1. Potential fuel damage in the core thereby causing a release to the environment due to the loss of Decay Heat removal capability.
2. Potential fuel damage to the Spent Fuel Pool thereby causing a release to the environment due to the loss of the Spent Fuel Pool cooling capability.

Loss of Decay Heat removal capability has been analyzed and is described for several scenarios in a Memorandum from T. F. Wyke, Chief Engineer, Mechanical and Nuclear Division to E. M. Geddy, Manager Nuclear Operations on the subject of "ONS Loss of Decay Heat Removal" dated July 1, 1987. The loss of Decay Heat capability occurring during this incident is bounded by Scenario III.C.2.b of the Memorandum. This calculation assumed that the unit was in refueling mode, RCS temperature was One Hundred (100) degrees Fahrenheit, RCS depressurized, refueling canal completely drained, RCS loops drained down to ten (10) inches above loop centerline elevation, and time after shutdown at Seventy-two (72) hours.

The result of this conservative analysis indicates that the time to core uncovery would be two (2) hours and forty-nine (49) minutes. Since the Decay Heat level in our case (thirty-two (32) days after shutdown) was significantly lower and approximately one third of the core consisted of new fuel, the core uncovery time would be significantly longer that two (2) hours and Forty-nine (49) minutes.

Therefore, it can be concluded that operating personnel had ample time available to restore power to at least one LPI pump. It should be noted that two independent AC power sources (transformer CT-3 and CT-5) were available at all times and that a closure of any one of four (4) breakers was sufficient to restore power and, hence, to restore Decay Heat removal capability. During this incident, Control Room operators were fully aware of the loss of AC power situation, and used valid emergency procedures and restored power within 15 minutes.

The impact of this incident on fuel integrity in the Spent Fuel Pool of Unit 3 is bounded by an analysis described in the Final Safety Analysis Report, Volume 6, Chapter 9.1.3.3.2. This analysis assumed a complete loss of coolant circulation to the Spent Fuel Pool. The analysis shows that natural circulation flow within the storage tubes ensures that the peak clad surface temperatures remain below 650 degrees Fahrenheit, which is the normal temperature of the fuel in the core.

In conclusion, the loss of AC power for 15 minutes did not significantly increase the risk of fuel damage and of release of radioactivity to the environment and it is concluded that the health and safety of the public were not affected by this incident.

7.0 ENCLOSURES

None

8.0 REFERENCES

8.1 Final Safety Analysis Report

8.2 Station Directive 2.2.1

8.3 Station Directive 3.1.1

8.4 Station Directive 3.1.2

8.5 Operations Manual Procedure 1-9

8.6 Operations Manual Procedure 2-1

8.7 Personnel Interviews

Prepared By: Kenneth F Brown Date: 10-5-88

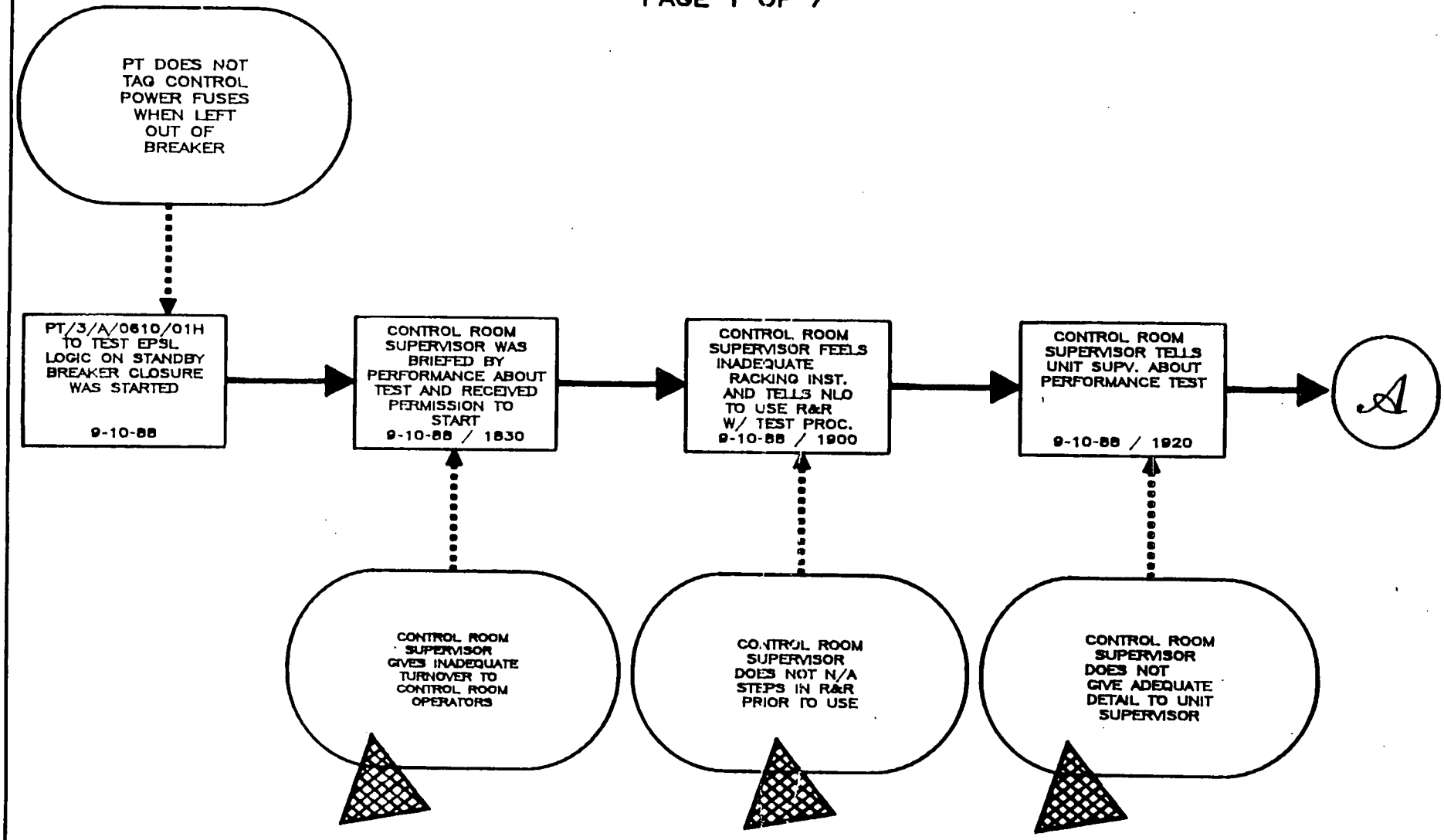
Reviewed By: Doug Berkshire Date: 10-5-88

Robert T Clarkson III 10-5-88

Approved By: Henry R. Lowery Date: 10-5-88

Chairman, OSRG

INVESTIGATION REPORT NO. IIR-88-25-3
CAUSAL FACTORS CHART



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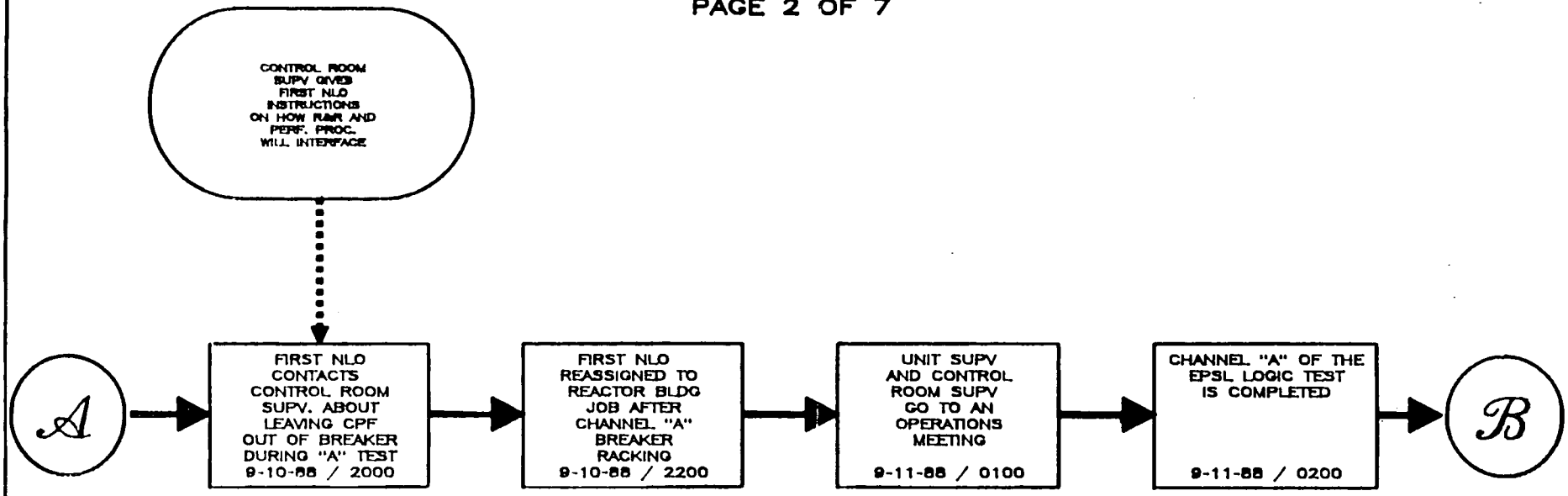

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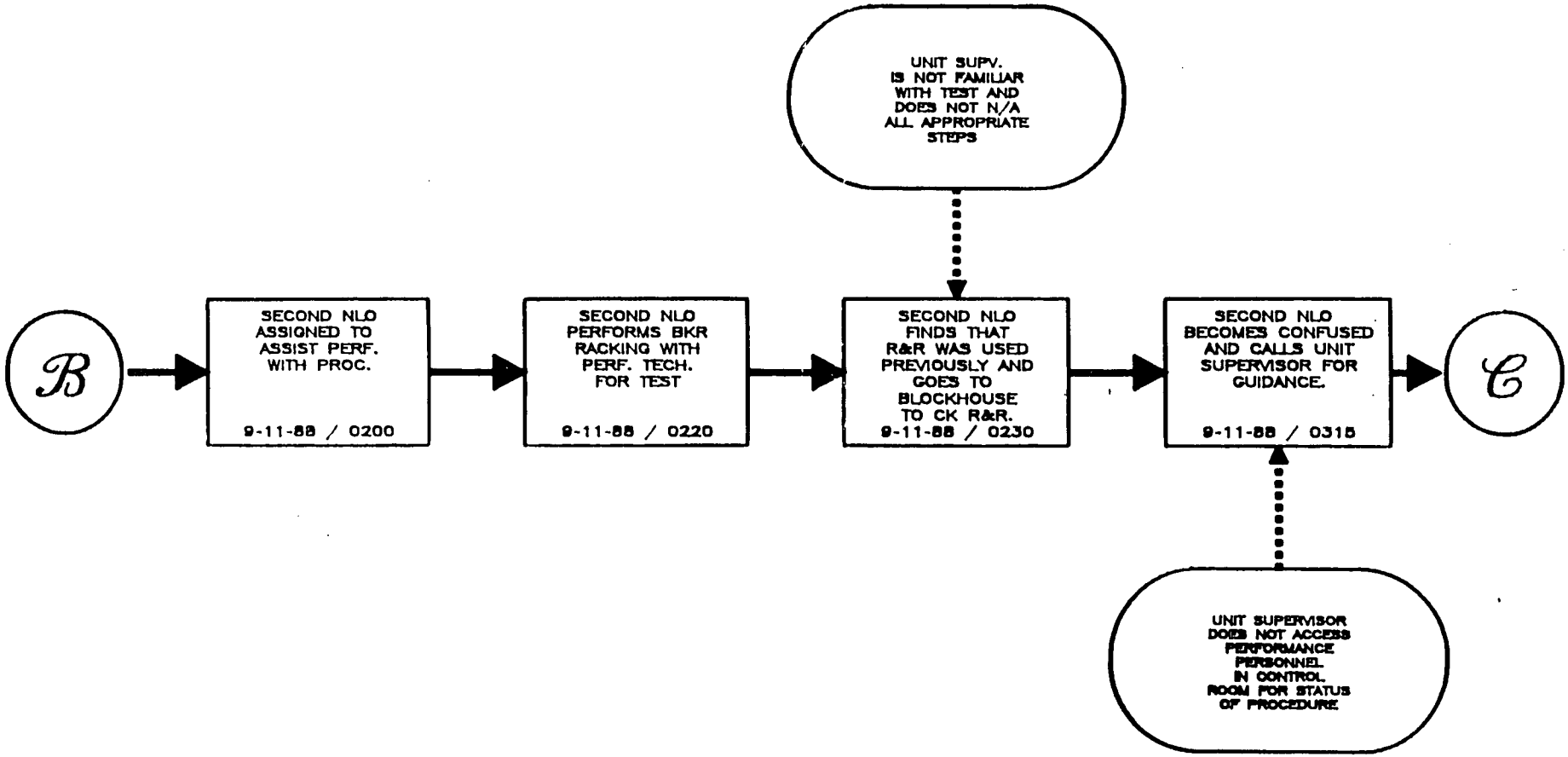

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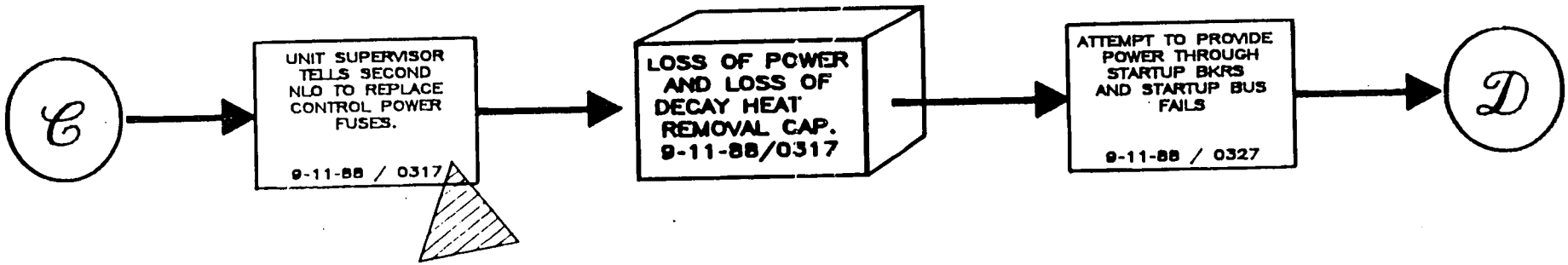

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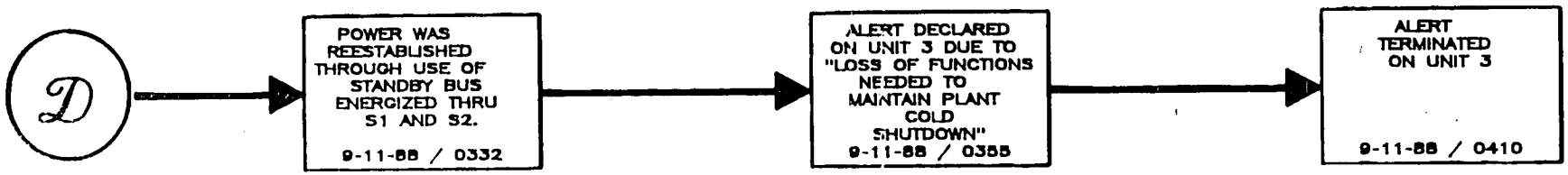

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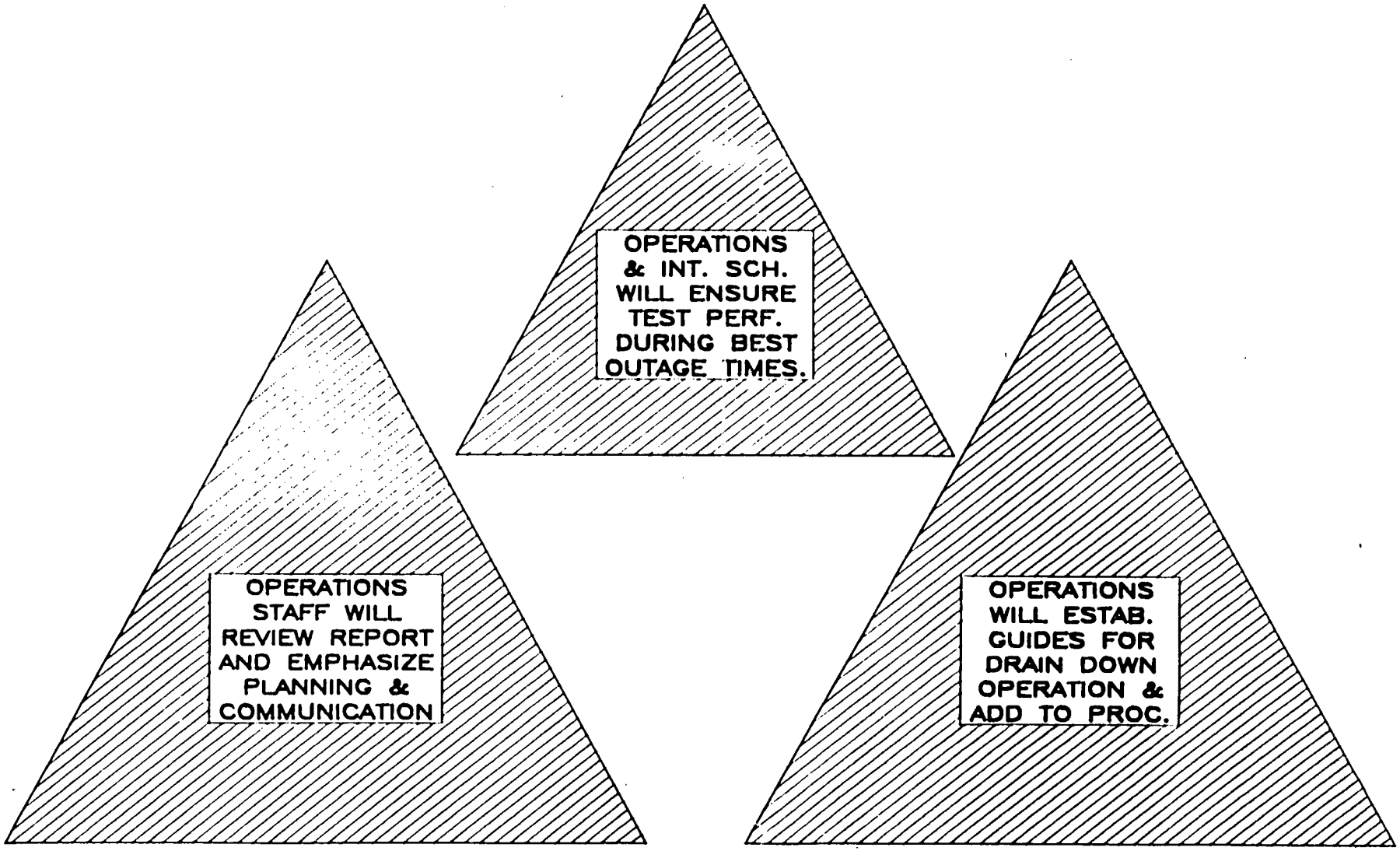
CAUSAL FACTORS CHART CORRECTIVE ACTIONS



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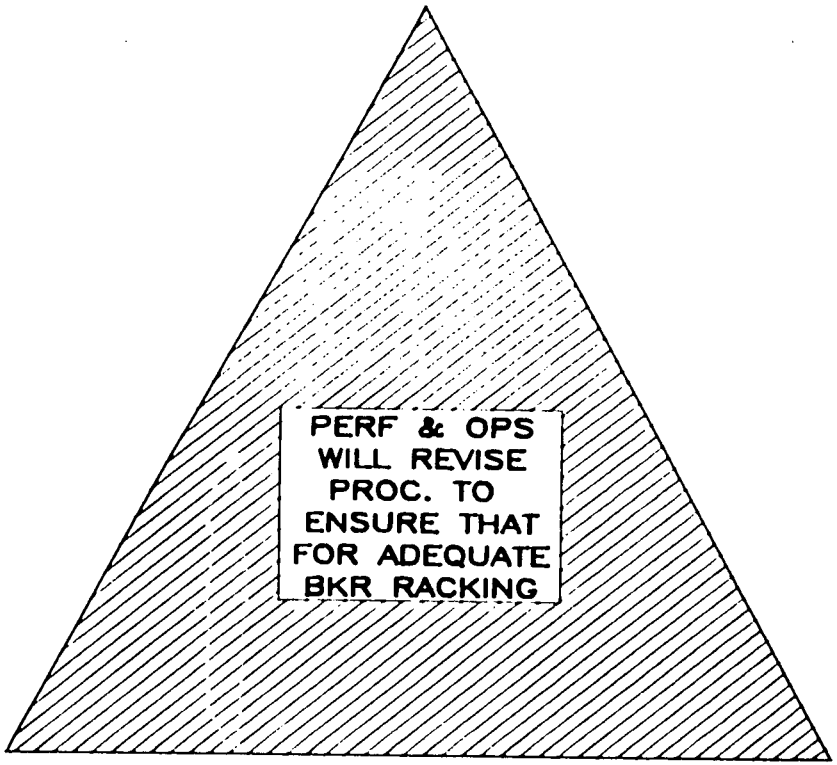

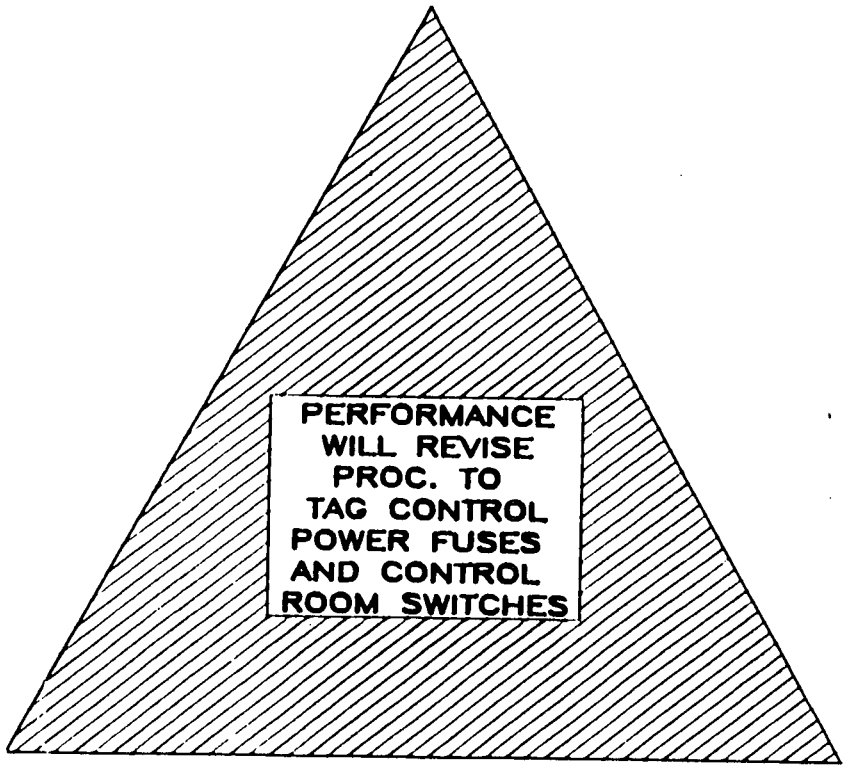

9.0 PERSONNEL INVOLVED

9.1

9.2 Corrective Action Responsibilities

9.2.1 Dick Sweigart (4.3.1), (4.3.2), (4.3.3), (4.3.5)

9.2.2 Dean Hubbard (4.3.3), (4.3.4)

9.2.3 Gary Rothenberger (4.3.5)