Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

December 5, 1997
3F1297-11

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: License Amendment Request #224, Revision 0
Reactor Building Fan Starting Logic Modification

Reference: FPC to NRC letter, 3F1097-04, dated October 3, 1997, License Amendment Request #21 Revision 0, Fan Logic Modification to AHF-1C Motor Control Center ES-MCC-3AB

Dear Sir:

Florida Power Corporation (FPC) hereby submits License Amendment Request (LAR) #224 for an amendment to Facility Operating License No. DPR-72 for Crystal River Unit 3 (CR-3). LAR #224 addresses a revision to the description of the starting logic for the Reactor Building (RB) Recirculation System Fan Coolers, as discussed in the CR-3 Final Safety Analysis Report (FSAR), Chapters 5, 6, 7 and 9, and Improved Technical Specification (ITS) Bases Section 3.6. The change to the starting logic is to ensure that only one RB Fan starts on an Engineered Safeguards (ES) Reactor Building Isolation and Cooling (RBIC) signal. A modification to the plant will install components that could increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the FSAR. FPC has determined that proposed changes to associated electrical controls involve an Unreviewed Safety Question (USQ). Therefore, NRC review and approval are required. An evaluation is included which concludes that the proposed changes do not involve a significant hazards consideration.

This modification is the corrective action for the issue identified in Licensee Event Report (LER) 97-025-00 concerning non-conservative assumptions previously used in Nuclear Services Closed Cycle Cooling (SW) System temperature calculations. The LER stated that the SW System may not be able to adequately transfer the heat load to the Ultimate Heat Sink (UHS) under the worst case accident conditions. These conditions include: a design basis Large Break Loss of Coolant Accident (LOCA), a low Reactor Building Fan Cooler fouling factor, two RB Fan Coolers

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operating in low speed, two SW pumps in service at maximum flow, failure of one Nuclear Services Seawater System (RW) Pump and maximum allowable UHS temperature (95° F).

Thermal analyses have shown that the SW System, as presently configured, is capable of transferring the post-LOCA heat loads under worst case conditions as long as UHS temperature remains below 79.9° F. Therefore, operation of CR-3 is acceptable with UHS temperatures below 79.9° F. Historically, UHS temperatures have remained below 79.9° F from before December 1 to after March 15. FPC will administratively apply the actions for Technical Specification 3.7.11 if Surveillance Requirement 3.7.11.2 indicates that UHS temperature is 79.9° F or above. These actions will be put into place through operating and surveillance procedures prior to entry into Mode 4 following our current outage.

NRC issuance of this amendment is not required to restart CR-3 from its current outage. However, this amendment is needed for CR-3 to operate with UHS temperatures above 79.9° F. In order to facilitate implementation, the modification is being constructed during the current outage. The modification will be installed, tested and then taken out of service by means of removable links prior to restart. Operation with the modification installed is considered a USQ, therefore, CR-3 will not connect the equipment added by the modification unless the NRC grants approval of this license amendment. After implementation of the proposed modification, CR-3 will be qualified to operate up to the current ITS UHS limit of 95° F.

FPC will revise surveillance procedures to test the modified RB Fan start logic on a 24-month frequency. The new starting logic is essential to ensure proper operation of equipment cooled by the SW System following an accident. FPC will revise the Emergency Operating Procedures (EOPs) to have operators verify that only one RB Fan starts on an RBIC signal to ensure the fan logic has actuated properly.

To support continued operation of CR-3, FPC requests that this license amendment be approved by February 13, 1998, with a 30-day implementation period to allow final installation and testing of the modification and to finalize the required procedural changes.

FPC has determined that this modification makes the SW System operable with a UHS temperature of up to 95° F. Therefore, approval of this change will permit continued operation of CR-3 per our current ITS requirements. Because this change reduces the number of RB Fans that will be available in some accident scenarios, FPC will evaluate other alternatives to determine the optimum long-term solution to this issue. This evaluation will be completed by July 31, 1998. FPC will advise the NRC of the results of this study by August 28, 1998.

This proposed modification involves a USQ and requires an amendment to the CR-3 operating license, and changes to the FSAR and ITS Bases. These changes are independent of the FSAR and ITS Bases changes submitted in LAR #217 for the AHF-1C Fan logic.

Attachment A provides a summary of the commitments made in this letter. Attachment B provides a description of the changes. Attachment C provides the 10 CFR 50.92(c) evaluation and conclusion that the proposed changes do not involve a significant hazard. Attachment D contains a sketch that supports the discussion in Attachment B. Attachment E provides proposed changes to the FSAR and ITS Bases. The pages submitted in Attachment E contain only the changes proposed for the currently discussed modification. The final form of the FSAR change will be submitted to the NRC consistent with 10 CFR 50.71(e) requirements.

If you have any questions regarding this submittal, please contact Mr. David Kunsemiller, Manager, Nuclear Licensing at (352) 563-4566.

Sincerely,

Roy A. Anderson
Senior Vice President
Nuclear Operations

RAA/pei
Attachments

cc: Regional Administrator, Region II
NRR Project Manager
Senior Resident Inspector

STATE OF FLORIDA

COUNTY OF CITRUS

Roy A. A erson states that he is the Senior Vice President, Nuclear Operations for Florida Power Corp on, that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Co ission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

Roy A. Anderson
Senior Vice President
Nuclear Operations

Sworn to and subscribed before me this 5th day of December, 1997, by Roy A. Anderson.

Charlene Miller

Signature of Notary Public
State of Florida

CHARLENE MILLER
COMMISSION NO. CC585870
EXPIRES 11/4/2000
BONDED THRU ASA 1-888-NOTARY1

(Print, type, or stamp Commissioned Name of Notary Public)

Personally Known ✓ -OR- Produced Identification ______

FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT 3
DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #224
REVISION 0

REACTOR BUILDING FAN
STARTING LOGIC MODIFICATION

ATTACHMENT A

LIST OF COMMITMENTS

ATTACHMENT A

List of Regulatory Commitments

The following table identifies those actions committed to by Florida Power Corporation in this document. Any other actions discussed in the submittal represent intended or planned actions by Florida Power Corporation. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager, Nuclear Licensing of any questions regarding this document or any associated regulatory commitments. Commitments 3F1297-11-2 and 3F1297-11-3 are contingent upon NRC approval of the proposed changes in this submittal.

ID Number	Commitment	Commitment Date
3F1297-11-1	FPC will administratively apply the actions for Technical Specification 3.7.11 if Surveillance Requirement 3.7.11.2 indicates that UHS temperature is 79.9° F or above. This restriction applies until the installation of MAR 97-09-05-01, RB Fan Run Logic.	Prior to entry into MODE 4 following the current outage
3F1297-11-2	FPC will revise surveillance procedures to test the modified RB Fan start logic on a 24-month frequency.	March 15, 1998
3F1297-11-3	FPC will revise the EOPs to direct operators to ensure that only one RB Fan starts on an RBIC signal.	March 15, 1998
3F1297-11-4	FPC will evaluate other alternatives to determine the optimum long-term solution to this issue. This evaluation will be completed by July 31, 1998. FPC will advise the NRC of the results by August 28, 1998.	August 28, 1998
3F1297-11-5	FPC will transmit the independent FMEA to the NRC after the final version has been received and reviewed by FPC.	January 9, 1998
3F1297-11-6	The NRC will be notified if the final EDG load calculation case study results in a different conclusion than the evaluation that has been completed to date.	Conditional as described in commitment

FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT 3
DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #224
REVISION 0

REACTOR BUILDING FAN
STARTING LOGIC MODIFICATION

ATTACHMENT B

EVALUATION OF LICENSE AMENDMENT REQUEST

EVALUATION OF LICENSE AMENDMENT REQUEST #224

SUMMARY OF CHANGES

The changes to the CR-3 FSAR and ITS Bases are being made to reflect the new starting logic proposed by Modification Approval Record (MAR) 97-09-05-01. This modification will ensure that only one Reactor Building (RB) Fan will start in slow speed upon receipt of a Reactor Building Isolation and Cooling (RBIC) signal (occurs at RB pressure of 4 psig). For the purposes of this discussion, the 'A' Train RB Fan will be selected as the lead fan. If the lead fan fails to start, the backup fan ('B' Train) will start several seconds later. The FSAR and ITS Bases must be revised to accurately reflect the modified operation of the RB Fans. This submittal is being made because installation of this modification involves an unreviewed safety question (USQ). The primary concerns are that the new RB Fan starting logic is more complex and may increase the probability of the malfunction of equipment important to safety and the addition of single failures that could result in a reduction in cooling by the RB Fans.

CURRENT CONFIGURATION

Reactor Building Ventilation System

The RB Fan Coolers are part of the RB recirculation subsystem (AH-XA). This system is comprised of the RB Fans and motors, associated cooling coils, dampers, motor coolers, and ductwork. The RB Fans draw air from various locations throughout the RB. The air is drawn across the coils of the RB Fan Coolers to remove sensible and latent heat. Under normal cooling conditions, the coils are supplied with Industrial Cooling (CI) System water. In the event of an actuation of the RBIC System, the coils are automatically changed over to the SW System cooling water supply. A sketch of the RB Fan Cooler interface with the SW and RW System is included in Attachment D, Figure 1.

There are three installed RB Fan Coolers, but operation is currently restricted to two at any one time due to limitations on emergency power supply and SW System heat load. The third RB Fan Cooler is maintained isolated and unavailable (a separate License Amendment Request for use of the 'C' RB Fan has been submitted in LAR #217). Upon actuation of the RBIC signal, running fans are tripped and the two ES-selected RB Fan Coolers receive a slow-speed start signal.

The function of the RB recirculation subsystem is:

1. Remove or add sensible heat under normal conditions of operation to maintain average RB air temperature below the Improved Technical Specification limit (130°F) and above the minimum temperature of 60°F.

2. Remove sensible and latent heat under post-accident conditions to reduce the building temperature and pressure from pre-determined maximum values. This is an Engineered Safeguards (ES) function.

3. Recirculate air through demisters and throughout the reactor building during both normal and post-accident conditions.

4. Maintain uniform temperature throughout the building during the integrated leak rate test.

5. The safety function of the AH-XA System is to provide the RB emergency cooling function in order to limit post-accident RB pressures and temperatures to within design values. The RB Ventilation System is backed up by the Reactor Building Spray System in support of this function.

PROPOSED MODIFICATION

Background

Recent analyses associated with Restart Issue D-28, "Further Evaluation of Variables Used in Service Water Heat Exchanger (SWHE) Blockage Calculation," have shown that the SW System can become overheated due to excessive heat removal from the RB following a postulated LOCA. The RB heat removal is via the RB Fan Coolers. Previous analyses (including original SW System design and sizing studies) assumed that the RB Fan Coolers operated in the worst case degraded (fouled) condition and that fan coil cooling water (SW) flowrate was at the minimum design point (i.e., one of two emergency SW pumps in service at minimum acceptable performance). These assumptions are conservative with respect to the containment peak temperature and pressure analysis, but not for the maximum SW load calculation.

The RB Fan Coolers could actually be in a clean, non-degraded condition and two emergency SW pumps could be in-service post-LOCA (this is the normal condition since both receive an ES start signal). These assumptions result in a considerably greater predicted heat transfer rate from the RB atmosphere to the RB Fan Coolers than previously evaluated. It was determined that the SW heat exchanger's capability to transfer heat to the ultimate heat sink (UHS) would be inadequate with one RW pump running, and at high UHS temperatures if two RB Fans were in operation after a Large Break LOCA. The resulting higher temperature of the SW cooling water would exceed the system temperature design basis and the analyzed cooling water temperature for the SW cooled equipment. The most limiting component is the Control Complex Chiller which cannot perform its cooling function with SW temperatures above the currently analyzed limits.

Detailed Description of the Change

The proposed modification changes the response of the RB Fan Coolers to an RBIC actuation signal. Specifically, instead of starting two RB Fans in slow speed, the RBIC signal will result in only one RB Fan operating. This modification will be accomplished by a design change to the electrical starting circuit for the RB Fan motors. The modification will not affect manual operation of the RB Fans under normal conditions.

The modified fan motor starting scheme is shown schematically in Attachment D, Figure 2. The modification permits only one RB Fan to start and run in slow speed in response to an RBIC actuation signal. This starting logic is accomplished through a circuit that provides a 'lead' and 'back-up' arrangement for the ES selected RB Fans. The operating status of the lead fan determines whether to start the backup RB Fan. In the event that the lead RB Fan fails to operate, the ES start of the backup RB Fan is enabled and restart of the lead RB Fan is prevented. For purposes of this discussion, the 'A' train RB Fan will be selected as the lead fan. The lead fan is selected by setting its time delay to approximately 1.5 seconds. The backup fan's time delay is set at approximately 6.0 seconds. The shorter time delay for the lead fan is the only difference between the lead fan and the backup fan circuit.

The backup RB Fan could become the lead fan if there is a delay in the actuation of the lead RB Fan. Such a delay could be caused by failure or delayed start of the associated emergency diesel generator (EDG) (with a loss of offsite power) or failure or delay of the associated RBIC signal. If such a delay occurred, the backup RB Fan ('B' train) would act like the lead RB Fan ('A' train) in these discussions, and the lead RB Fan ('A' train) would act as the backup RB Fan ('B' train) as described below. Whether the 'A' or 'B' RB Fan is the lead fan makes no significant difference to the analysis conclusions or the operation of the RB Fan cooling system.

A discussion of the operation of the modified circuit follows. After the modification, if the 'A' RB Fan is the lead fan, then the 'B' RB Fan will be the backup fan. The 'C' RB Fan is assumed not to be ES selected. The 'C' RB Fan can be substituted for either the 'A' or 'B' fan as the lead or backup fan, respectively. The operation of the 'C' RB Fan circuit is the same as for the fan for which it is substituted. The use of the 'C' RB Fan is pending NRC review and approval of LAR #217.

When RB pressure exceeds 4 psig, an ES actuation and RBIC signal would be generated and the operating RB Fans would trip from fast speed. Then, a slow speed start signal is generated, energizing the RB Fans start timer relays (TDE-A for 'A' fan and TDE-B for 'B' fan on Figure 1 in Attachment D). After a short time delay (approximately 1.5 seconds), the TDE-A relay changes state, closing the relay contact TDE(A). If no other RB Fans are operating in fast or slow speed, contacts '42a Fast' and '42a Slow' for 'B' and 'C' trains will be open and therefore relays 42X(B) and 42X(C) will be de-energized and contacts 42X(B) and 42X(C) in the 'A' fan motor start circuit will be closed. This energizes the coil '42(A) Slow' which closes the fan starter contactor and starts the 'A' RB Fan.

If the 'A' fan fails to start as indicated by the starter contactor not closing, the 'B' fan would start as follows. When the start signal was generated from the RBIC signal, the TDE-B time delay relay was energized. After 6 seconds, the relay would change state, closing the TDE(B) contact in the 'B' fan start circuit. Since 'A' fan did not start, and 'C' fan is not running, the 42X(A) and 42X(C) contacts would be closed, and coil '42(B) Slow' would energize, starting the 'B' fan motor.

The time delay relays TDD(A), TDD(B) and TDD(C) are in the circuit to allow the manual start of a second RB Fan after RBIC is reset. For the 'A' RB Fan, this relay is energized when an RBIC signal is present and contact TDD(A) is open. When RBIC is reset, relay TDD-A is de-energized, and after a short time delay, the contact TDD(A) closes. The closed TDD(A) contact allows continuity to the '42A Slow' relay coil through the '42(A)a' seal-in contact even with another fan operating (which opens contact 42X(B) or 42X(C)). This feature allows the start of a second RB Fan under operator control later in the event when heat load from the RB is reduced.

This modification adds three relays to the 'A' and 'B' fans and five relays to the 'C' fan control schemes. For the 'A' and 'B' fans there are two timing relays, one is a time delay to energize relay and one is a time delay to de-energize relay, these two relays require 8 watts for each relay. For the 'C' fan there are four timing relays, two for each of the ES actuation signals and are the same as those used on the 'A' and 'B' fans. The final relay, which is required for all three fans, is an auxiliary relay that requires 23 watts of power for operation. The auxiliary relays receive their actuation directly from the fast and slow speed contactor contacts. Calculations confirm that the existing Control Power Transformers have adequate capacity for the additional 39 watts for the 'A' and 'B' fans and the 55 watts for the 'C' fan. Existing control circuit fuses are sufficiently sized to accept the additional load and adequately protect the new relays.

New equipment boxes will be installed for fans AHF-1A, AHF-1B and AHF-1C to house the electrical components and wiring in order to maintain circuit separation requirements. The installation and wiring will be installed in accordance with the requirements of the Electrical Design Criteria (Electrical Circuit Physical Separation and Cable Tray Loading), the National Electric Code and IEEE 308 June 1969. Separation of the auxiliary relay control power cables from the same train cables in the Motor Control Centers (MCCs) will be accomplished by installing flexible conduit inside the MCC wireways to as close as is practical to the Control Power Transformer fuses. These cables will be run in separate conduit and "Siltemp" wrapped (for separation) at the MCC compartments and the new terminal boxes.

After the modification, the Reactor Building fans will have the following manual/automatic control features:

a. With no fans running at slow speed and an RBIC actuation occurs, one fan will automatically start at slow speed and no other fans can be started (in all cases, a fan can be manually started after the RBIC signal is bypassed).

b. With one fan running at slow speed and an RBIC actuation occurs, that fan continues to run at slow speed and no other fans can be started.

c. With two fans running at slow speed and an RBIC actuation occurs, both of the fans will stop and one fan will automatically start at slow speed and no other fans can be started.

d. When the RBIC actuation is bypassed, one fan will continue to run at slow speed and no other fans will automatically start. A second fan can be manually started.

e. With an RBIC actuation standing and the running fan fails, another fan will automatically start and run at slow speed.

f. During normal plant operation, either one fan or two fans can be run in fast or slow speed. The fans can be started or stopped under manual control (this is the same as it was before the modification).

The new electrical logic is biased to select and run the lead RB Fan at slow speed on RBIC actuation. However, this is based on the assumption that both RBIC actuation signals occur simultaneously. If the backup fan's RBIC actuation precedes the lead fan's RBIC actuation by more than the difference in the time delays (approximately 4.5 seconds), then the backup fan will start first, preventing the start of the lead fan. The selection of which train RB Fan is the lead fan makes no difference to containment temperatures and pressures, and there is no adverse effect of starting the fans in reverse order.

The 'C' fan has identical logic to both the 'A' and the 'B' fans. If the 'C' fan is ES 'A' selected, it will be the preferred fan and logically biased to start first (if the 'A' train is the lead fan). Conversely, if the 'C' fan was ES 'B' selected, the 'C' fan would be logically biased as the secondary fan and will start if the 'A' fan fails.

Effect of Modification on Systems, Structures, and Components

Thermal hydraulic analysis shows that with only one RB Fan Cooler in service, the SW System is capable of rejecting post-accident heat loads to the UHS without exceeding containment pressure and temperature limits even at the highest expected UHS temperature of 95° F. This analysis considers the RB Fan loads in combination with the other emergency heat loads that would be cooled by the SW System following an accident. The analysis also shows that even under limiting accident conditions, the SW supply temperature remains below its limit of 110° F. Therefore, all equipment serviced by the SW System will be maintained within its qualification limits.

FSAR Section 6.3.1 states that the operation of one RB Fan Cooler and one RB Spray train is sufficient to remove the required accident heat load from containment (i.e., the design pressure and temperature are not exceeded). The assumption of one train of safeguards equipment for response to an accident is also the basis for the RB post-accident temperature profile used for environmental qualification (EQ) of electrical equipment in the RB. Therefore, since this equipment will still be available, there is no effect on the EQ of RB equipment.

The emergency electrical loads added by this modification are small (a few watts) and have been evaluated to show that there is no adverse effect on emergency bus or EDG electrical loading. The logic circuit modification could result in the start of an RB Fan out of the normal block loading sequence. An evaluation of the out-of-sequence loading of an RB Fan for 'A' EDG (the limiting EDG) has been performed and shows that the EDG load remains within limits. The NRC will be notified if the final EDG load calculation case study results in a different conclusion than the evaluation that has been completed to date.

The modification will involve the FSAR and ITS Bases changes described in Table 1. Most of these revisions are being made to reflect that the RB Fan logic will start one fan instead of two fans on an RBIC signal. The remaining revisions reflect changes to fouling factors used in the SW thermal hydraulic calculations, associated simplifications of the SW heat removal discussion and the removal of obsolete information. The proposed license amendment is needed to make the changes to the ITS Bases and the FSAR that reference the use of only one RB Fan.

TABLE 1: PROPOSED CHANGES TO THE FSAR AND ITS BASES

SECTION	TITLE	DESCRIPTION OF CHANGE
FSAR 5.5.1.2.c	Emergency cooling load; Loss of Coolant Accident (LOCA)	Delete existing text and replace it with "One RB cooler shall have the capability to remove a minimum of 80 x 10^6 BTU/hr from the RB Atmosphere via condensate to the RB Sump and heat transfer to the SW System."
FSAR 5.5.3.2	Emergency Operation	Change "The two ES selected motors" to "one motor"
FSAR 6.3.1	Reactor Building Emergency Cooling System, Design Basis	Delete one RB Spray, two RB Fan case as an acceptable option of maintaining RB temperature and pressure. Renumber options to reflect the deleted case. The two RB Spray, one RB Fan case was added as the normal response to an ES signal. The three RB Fan case was deleted since it is no longer valid.
FSAR 6.3.3	Reactor Building Emergency Cooling System, Actuation	Revise the Actuation section to reflect that only one RB Fan will start on an ES signal.
FSAR Table 6-9	Single Failure Analysis Reactor Building Emergency Cooling System	Revise Item 3 to reflect that the two RB Spray trains can mitigate the accident if the running RB Fan has SW to its cooling unit isolated.
FSAR Table 6-10	Reactor Building Cooling Unit Performance and Equipment Data	The number of RB Fans required is changed from 2 to 1. Footnote (a) is revised to indicate that no more than one RB Fan will operate following an ES signal (fan logic prevents two fans from operating at the same time). Footnote (b) is replaced with "One RB cooler shall have the capability to remove a minimum of 80 x 10^6 BTU/hr from the RB atmosphere via condensate to the RB sump and heat transfer to the SW System." Footnote (c) is deleted and (d) is renamed (c).
FSAR 7.1.3.2.3.a	HPI and Loading Sequence	Add a note that states "Only one RB Fan will operate at one time (Fan logic prevents two fans from operating at the same time). If the lead fan fails to start or trips after starting, a second fan will start. The backup fan start could occur in block 2, 3, 4, 5, 6 or later." Change "fans" to "fan."
FSAR 9.7.2.1	Modes of Operation	Revise subsection b. to indicate that only one RB Fan will run during emergency operations. Add paragraph "To prevent overloading the SW System during emergency operation, the Reactor Building Fan logic will prevent the operation of more than one fan. On an ES actuation signal, the lead fan will start and the remaining fans are prevented from starting. Starting an additional fan can occur after ES is bypassed. If the lead fan fails to start or trips while in service, a backup fan will start."
ITS Bases 3.6.6	Reactor Building and Containment Cooling System	Revise the background section to reflect that only one RB Fan will start on an ES signal. Revise SR 3.6.6.7 Bases to reflect that the SR will ensure that only one RB Fan starts on an ES signal and that the running fan switches to low speed and the other running fan trips.

REASON FOR REQUEST

This modification involves a USQ because it could increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the FSAR.

Description of Unreviewed Safety Question

The new logic circuit adds a level of complexity to the starting of the RB Fans in that additional relays and relay contacts are depended upon for the start of the RB Fan. Increased complexity in the electrical circuit can increase the probability that the equipment will fail to perform its safety function.

The failure effects evaluation performed for this change shows that for single failures associated with the circuit modification, there are no credible electrical failures that could result in both RB Fans operating following an RBIC actuation. There are, however, single failures that result in no RB Fans operating. These failures are bounded by previous analysis that was done to evaluate the failure of the common SW supply or return header transfer valve to open, resulting in no cooling water to both the RB Fan Coolers (Valves A and B on Figure 1, Attachment D). This condition was previously evaluated and found acceptable because two trains of RB Spray are available to provide RB heat removal. Both trains of RB Spray are available because there is no common mode failure that would cause the SW valves not to open and cause the RB Spray pumps not to start. Although this new failure is bounded by the analysis, the creation of a single electrical failure that could prevent both RB Fans from starting does result in a small increase in the probability of malfunction of equipment important to safety.

This modification also creates a new single failure that is similar to the failure of the SW supply or return header transfer valves to open. This failure involves closure of an individual RB Fan Cooler SW supply or return line isolation valve (Valves C and D on Figure 1, Attachment D). These valves are normally open when an RB Fan is in service. The return isolation valve closes when an RB Fan is stopped after a one-minute time delay. If either the supply or return isolation valve were to fail closed, there would be no cooling water flow to the associated RB Fan Cooler. If the affected RB Fan Cooler is the unit selected to operate by the modified start circuit, then there would be no containment heat removal capability from RB Fans. The backup fan would not start because the lead fan would appear to be operating normally. This failure would result in no RB Fan cooling to the containment and successful accident mitigation would rely on the RB spray system.

The proposed modification does not affect the SW supply or return valves and does not increase the probability of occurrence of the malfunction of these valves. However, this new failure mode represents an increase in the probability of malfunctions that result in a failure of the RB Fan Coolers to effectively remove heat from the containment. Previously, only two SW valves could cause the loss of heat removal capability. After the modification, two additional SW valves per train could impact the RB Fan cooling ability. Due to the additional susceptibility of the RB Fan Cooler to SW System single failures, it has been determined that, although the increase is small and depends upon specific operational circumstances (SW valve failure would have to be on the operating train fan), this activity could increase the probability of occurrence of a malfunction of equipment important to safety.

JUSTIFICATION FOR REQUEST

<u>Relay USQ</u>

The modification to the RB Fan motor start circuit adds additional electrical components to the safety system accident response scheme. These added components are procured, designed, installed and tested under the safety-related requirements of nuclear quality assurance programs. These are highly reliable components and the scheme is designed for high reliability. The single failure criteria consistent with the plant design and licensing basis has been used throughout the design of this change. The probability of the malfunction of these relays is on the order of 10^{-6} to 10^{-7}. This failure probability is typical for safety-related relays. Therefore, FPC has determined that the probability that these components will fail is very small.

FPC has determined that the addition of these components provides significant benefit. The design of the RB Fan start circuit ensures that the SW System will not be thermally overloaded during the initial stage of containment cooling following an accident. Thermal analyses have been performed to show that the heat rejection capability of the SW System to the UHS is sufficient to accommodate all post-accident heat loads with only one RB Fan Cooler in service, even at maximum UHS temperatures. The design of the circuit is such that no credible single failure will result in two RB Fans operating. Therefore, the probability of failure of the SW System is reduced by this change.

<u>SW Valve USQ</u>

The change to the RB Fan start logic increases the susceptibility of the RB Cooling System to single failures in the SW System cooling water supply and return lines. These single failures could result in ineffective containment heat removal from the RB Fan Coolers. The probability that a SW valve would fail closed in the operating RB Fans cooling System is low and has not changed due to this modification. Even if this failure were to occur, the SW valve failures cannot result in a total loss of post-accident RB cooling since the RB Sprays will be available. The heat removal capability of the RB Spray System is described in the FSAR and concludes that operation of both RB Spray Trains, without the operation of RB Fans, is adequate to prevent exceeding containment design limits and preserve long-term temperature and pressure reduction requirements. The RB Spray pumps are cooled by the Decay Heat Closed Cycle Cooling Water System (DC) and therefore are not affected by the failure of the SW System valves.

Electrical/ Emergency Diesel Generator Impact

The additional electrical components installed by this change add a small amount of electrical load to the ES electrical System, and thus the EDG. This small additional loading has been evaluated and found acceptable for all affected components. The RB Fan start circuit changes also introduce the possibility of start delays for the RB Fans and could result in the start of an RB Fan out of the normal block loading sequence. The out-of-sequence loading of an RB Fan on the EDG has been evaluated and found to be acceptable. These electrical effects of the change, therefore, do not increase the probability of malfunction of any equipment important to safety.

Impact on Design Basis Accidents

The RB Fan Coolers, in conjunction with the RB Sprays, function as the RB Emergency Cooling System. These systems remove heat from the RB following an accident in order to limit the peak pressure and temperature to within design limits, and to provide long-term cooling and depressurization to minimize the escape of fission products to the atmosphere and to maintain the qualification of emergency equipment located in the RB.

The design basis accidents that can challenge the integrity of the containment are:

Main Steam Line Break (MSLB) - FSAR 14.2.2.1
Rod Ejection Accident (REA) - FSAR 14.2.2.4
Loss of Coolant Accident (LOCA) - FSAR 14.2.2.5

The REA effects on containment are enveloped by the containment response to a LOCA. The containment response to a MSLB is a rapid pressure and temperature increase followed by a rapid decrease. The mass and energy released during the worst-case MSLB is small compared to that released during a LOCA. The duration of elevated pressure and temperature in response to the MSLB is short, and therefore, the effects of LOCA on SW System heat loading are bounding. In addition, the RB Spray System and the RB Fan Coolers are not credited for mitigation in the MSLB accident analysis. Thus, this modification on RB Fans has no effect on the MSLB accident analyses.

Containment LOCA Analysis

In order to present a conservative analysis for the reactor building pressure response, a single failure of one emergency diesel was assumed in the FSAR analysis which results in the availability of only one train of ECCS Systems. This includes one High Pressure Injection (HPI) pump, one Low Pressure Injection (LPI) pump, one RB Fan Cooler, and one RB Spray pump. The RB Fan Cooler was assumed to be operating within 25 seconds. The required fan will still be able to meet the 25 second actuation criterion with the time delays added by this modification (1.5 seconds for the lead fan, 6 seconds for the backup fan).

The time delays have been shown through sensitivity studies to have no affect on the containment conditions in the event of a LOCA. An analysis has been performed that shows that the containment peak pressures and temperatures are not affected even if the RB Fans do not start for up to several minutes. Additionally, the long term temperature profile is not affected by the short time delays in the start of the RB Fans. Therefore, the time delays associated with this modification will not impact the results of the LOCA analysis.

This modification has no effect on the response of the RB Spray System to an ES actuation. Therefore, since the LOCA accident analysis is performed assuming the single-failure of an EDG/ES electrical bus, the minimum safeguards equipment assumed to respond to a LOCA is not changed and there is no effect on the accident response or post-accident containment conditions.

The 7.0 ft^2 cold leg break bounds the effects on the SW System since it represents the highest rate of energy addition to the RB atmosphere, and thus to the SW System. LOCAs that are smaller than the limiting case Large Break LOCA also add significant amounts of energy to the containment and can result in large heat transfer rates to the SW System via the RB Fan Coolers. However, the lower rate of energy addition for the smaller break sizes results in a longer time period for the integrated energy transfer to the SW System, and thus a longer period of time for energy removal to the UHS. Therefore, the smaller LOCAs do not present the limiting challenge to the SW System.

Thermal hydraulic analyses have been performed to show that with only one RB Fan Cooler in service post-accident, the heat rejection to the UHS is adequate to limit the SW System supply temperature to within its limit of 110° F, even at the highest expected UHS temperature of 95° F. Additionally, the worst-case containment challenge (due to a Large Break LOCA) is analyzed based on the response of one train of safeguards equipment (i.e., one RB Fan Cooler and one RB Spray) and is acceptable.

The containment response to a LOCA is not changed by this modification. All containment design conditions are still met and integrity of the fission product barrier is assured. Therefore, the consequences of a malfunction of the RB Fans are not increased as a result of this change since the assumptions of the FSAR analysis (i.e., minimum of one RB Fan and one RB Spray, or two RB Spray trains) are maintained.

Radiological Consequences of LOCA

The containment peak pressure analysis assumes minimum safeguards equipment is available to mitigate the effects of LOCA due to the failure of an EDG or ES electrical bus. The modification to the RB Fan start circuit ensures one RB Fan is in operation post-LOCA and the modification has no affect on the RB Spray System. The assumptions of the FSAR analysis of LOCA effects on the RB are not changed. Therefore, there is no effect on the release of fission products to the environment.

Failure Modes and Effects Analysis

FPC has performed a Failure Modes and Eff   s Analysis (FMEA) and has determined that there are no credible single failures that could result in two RB Fans operating after an RBIC signal. FPC has contracted an independent firm to perform an FMEA to verify the conclusions of our analysis. Preliminary results from the independent review concur with the conclusions of the FPC FMEA. FPC will transmit the independent FMEA to the NRC after the final version has been received and reviewed by FPC. Several potential new failure modes were evaluated and determined not to affect the safety analysis. A summary of the disposit n of each potential new failure mode is discussed below.

Potential New Failure Modes

There are several potential failure modes that have been created or altered by this proposed change. The first is the failure of a SW System supply or return isolation valve. The SW cooling supply or return valve could fail closed, isolating cooling water flow to one RB Fan. The probability of this failure has not changed, however, the impact of the failure has changed. Previously, this failure would result in a condition where both fans would be running but only one train would have cooling. This modification will change the logic such that only one fan will start. The circuitry checks to ensure that only one fan is running. If the lead RB Fan starts without cooling flow, the backup RB Fan will not get a start signal because electrically the lead RB Fan will appear to be operating normally. However, the running fan will not perform its heat removal function without SW cooling flow. This case is effectively the same as the failure of a SW System supply or return header transfer valve which isolates cooling water flow to all RB Fans. Since the single failure for this scenario is the failure of the SW valve, credit can be taken for the operation of both RB Spray trains. The FSAR states that two RB Sprays are capable of providing 100 percent of the post-LOCA containment cooling requirements. The two RB Spray case has already been credited for cases where SW is isolated to all RB Fans. Therefore, this changed failure mode is still within the bounds of the analysis and will not create a different type of accident or malfunction.

The second new failure mode is if no RB Fans start on an RBIC signal. If neither RB Fan starts, then there is no heat removal from containment by the RB Fan Coolers. Therefore, there is no potential to overheat the SW System. As previously discussed, the containment temperature and pressure analysis is acceptable even with no cooling from the RB Fan Coolers because two RB Spray trains are available. There are no common mode failures that would cause both RB Fans and either RB Spray pump not to start. Therefore, there will always be at least one RB Spray train and one RB Fan Cooler or two RB Spray trains available for accident mitigation.

Another potential failure mode that was evaluated is the inadvertent start of two RB Fans. Previously, the start of two RB Fans was the normal result of an RBIC signal and not a failure mode. With the revised starting circuitry, one and only one RB Fan is started. The start of two fans following a Large Break LOCA could result in SW temperatures in excess of the 110° F design limit with high UHS temperatures. The increased SW temperature could result in the common mode failure of the equipment cooled by the SW System.

Failure mode analysis has determined that no credible single failure could cause both RB Fans to start and remain operating. Even if a second fan were to inadvertently start, a relay would open a contact in the first fan's circuitry to immediately trip the first fan. For example (reference Figure 2, Attachment D), if the 'B' RB Fan were to inadvertently start in slow speed (42(B) Slow coil energized), its 42a Slow contact would close, energizing the 42(X)B relay which opens the 42X(B) contact in the 'A' and 'C' fan starting logic, tripping any other fan that is running. A similar sequence would occur if the 'B' fan were to start in fast speed. The modification ensures that two RB Fans will not operate simultaneously while an RBIC signal is present. Therefore, the operation of two RB Fans is not considered credible and a new malfunction of equipment important to safety is not created.

Another failure that warrants discussion is that an RB Fan might not shift from fast to slow speed on an RBIC actuation. Shifting to slow speed protects the fan from overloading in the high density RB atmosphere after an accident. This failure is not a result of the modification and has always existed. However, before the discovery of the potential to overheat the SW System, the fan in high speed was always assumed to fail and not remove heat from the RB. The concern now is that the RB Fan might continue to operate and remove more heat from the RB than a fan in slow speed would. Analysis has determined that the heat removal capability of a fan in fast speed is not significantly greater than a fan in slow speed. A fan running in fast speed can transfer an additional 1.6 million BTU/hr (over the slow speed capability of greater than 80 million BTU/hr) to the SW System. The additional heat input produces less than 0.5°F increase in SW temperature. For the purposes of the analysis, a fan in fast speed is equivalent to a fan in slow speed for heat removal purposes. The additional 1.6 million BTU/hr heat load was considered in the analysis where appropriate.

CONCLUSIONS.

Allowing only one RB Fan Cooler to start maintains the accident analysis assumptions while preventing the potential overheating of the SW System. Reliability is maintained by providing a lead and backup fan design that ensures one fan will be available for containment heat removal. Several single failures exist that could prevent all RB Fans from starting or prevent cooling water from reaching both RB Fan Coolers or the active RB Fan Cooler. In these cases both RB Spray pumps will be available to mitigate the accident. The modification that is being installed has a high reliability to ensure that one and only one RB Fan will operate after an RBIC signal. In the unlikely event that either two or zero RB Fans are running post-accident, the operators are instructed by their Emergency Operating Procedures to ensure that one and only one RB Fan is in operation. The verification of proper RB Fan operation is done during the first few minutes of an accident requiring RBIC actuation. In summary, FPC concludes that the enhancements to overall system reliability outweigh the small potential increase in failure of the existing or added components.

FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT 3
DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #224
REVISION 0

REACTOR BUILDING FAN
STARTING LOGIC MODIFICATION

ATTACHMENT C

DETERMINATION OF NO SIGNIFICANT
HAZARDS CONSIDERATION
AND
ENVIRONMENTAL IMPACT EVALUATION

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION AND ENVIRONMENTAL IMPACT EVALUATION

An evaluation of the proposed license amendment has been performed according to 10 CFR 50.91(a)(1) regarding significant hazards considerations, using the standards in 10 CFR 50.92(c).

1. *Does not involve a significant increase in the probability or consequences of an accident previously evaluated.*

The change to the starting logic for the RB Fans affects the ES equipment that responds to mitigate an accident. The RB Fans are not accident initiators and the change to the starting logic cannot initiate an accident. Therefore, the probability of occurrence of an evaluated accident is not increased.

The RB Fan start logic change selects an available RB Fan to run upon an RBIC actuation, but only allows the operation of one RB Fan to prevent overloading the SW System. The containment analysis for CR-3 assumes that one train of ES equipment is available for accident mitigation, specifically, one RB Fan and one RB Spray train for containment cooling. The combination of two RB Spray trains with no RB Fans is also evaluated and found to be acceptable. These available containment cooling equipment combinations represent the minimum that would be available for accident response both before and after the implementation of this change.

In addition to the same equipment being available to mitigate an accident, there is no change to the analyzed containment response. The time delay in the start of an RB Fan of up to several seconds due to the modification has been evaluated through containment analysis sensitivity studies. The results of these studies show that containment peak pressure and temperature, and long term temperature profiles, are not affected. The consequences of an accident are directly related to containment pressure and temperature conditions. Since containment conditions following an accident are not affected by this modification, there will be no change to the consequences of any analyzed accident.

2. *Does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The modification changes the RB Fan start logic in the event of an accident. The new start circuit ensures that one RB Fan is operating in response to an RBIC actuation, but prevents the operation of two fans. This modification prevents the thermal overloading of the SW System in order to preserve the operability of equipment cooled by the SW System. Several potential new failure modes were evaluated and determined not to create the possibility of a new or different kind of accident.

Additionally, the RB Fans are engineered safeguards equipment designed to mitigate an accident, and the SW System is an accident mitigation support system. These systems are not accident initiators. The ES electrical busses and the EDG are not affected by this change. All containment design conditions are met with this change.

Therefore, this change cannot create the possibility of an accident of a different kind than previously evaluated in the SAR.

3 *Does not involve a significant reduction in the margin of safety.*

Technical Specification 3.6.6 states that two RB Spray trains and two RB containment cooling trains must be operable. This specification ensures diversity and redundancy of the containment cooling system. Following the modification, all margins will be maintained. Two RB Fans will be operable and capable of starting on an RBIC signal. The modified circuitry maintains the RB Fan redundancy. The RB Sprays are not affected by this modification.

The margin of safety associated witn the containment maximum pressure and temperature in response to a LOCA is not affected since any failure of this modification results in equipment combinations that have been analyzed and determined to be acceptable. Containment LOCA response sensitivity studies have verified that the small start delay, associated with the modified RB Fan start circuit, has no effect on the post-LOCA peak temperature and pressure in containment. Also, the failure of SW valves that results in the loss of the ability of the RB Fan Coolers to remove heat or the failure of either RB Fan to run, will not affect the containment peak temperature and pressure conditions since two trains of RB Spray are available.

The proposed modification allows only one RB Fan to operate post-accident. This ensures that the SW System is not overloaded and SW temperatures remain within design basis limits. Therefore, there is no reduction in the margin of safety for the SW System equipment cooling function after the implementation of this change.

The small additional electrical loads, and the out-of-sequence loading of an R.3 Fan associated with this change have been evaluated and determined to be within the load limits of the EDG and ES electrical busses. Therefore, there is no reduction in the electrical system margin of safety.

Based on the above evaluation, there is no reduction in the margin of safety associated with the equipment and systems affected by this change.

ENVIRONMENTAL IMPACT EVALUATION:

10 CFR 51.22(c)(9) provides criteria for and identification of licensing and regulatory actions eligible for categorical exclusion from performing an environmental assessment. A proposed amendment to an operating license for a facility requires no environmental assessment if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant hazards consideration, (2) result in a significant change in the types or significant increase in the amounts of any effluents that may be released off-site, or (3) result in a significant increase in individual or cumulative occupational radiation exposure. FPC has reviewed this license amendment and has determined that it meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(c), no environmental impact statement or environmental assessment need to be prepared in connection with the issuance of the proposed license amendment. The basis for this determination is as follows:

1. The proposed license amendment does not involve a significant hazards consideration as described previously in the evaluation.

2. As discussed in the significant hazards evaluation, this change does not result in a significant change or significant increase in the radiological doses for any Design Basis Accident. The proposed license amendment does not result in a significant change in the types or a significant increase in the amounts of any effluents that may be released off-site. FPC has concluded that there will not be a significant increase in the types or amounts of any effluents that may be released off-site and does not involve irreversible environmental consequences beyond those already associated with The Final Environmental Statement.

3. The proposed license amendment does not result in a significant increase to the individual or cumulative occupational radiation exposure because this is a change to automatic actuations only and does not require operator or other actions that could increase occupational radiation exposure.

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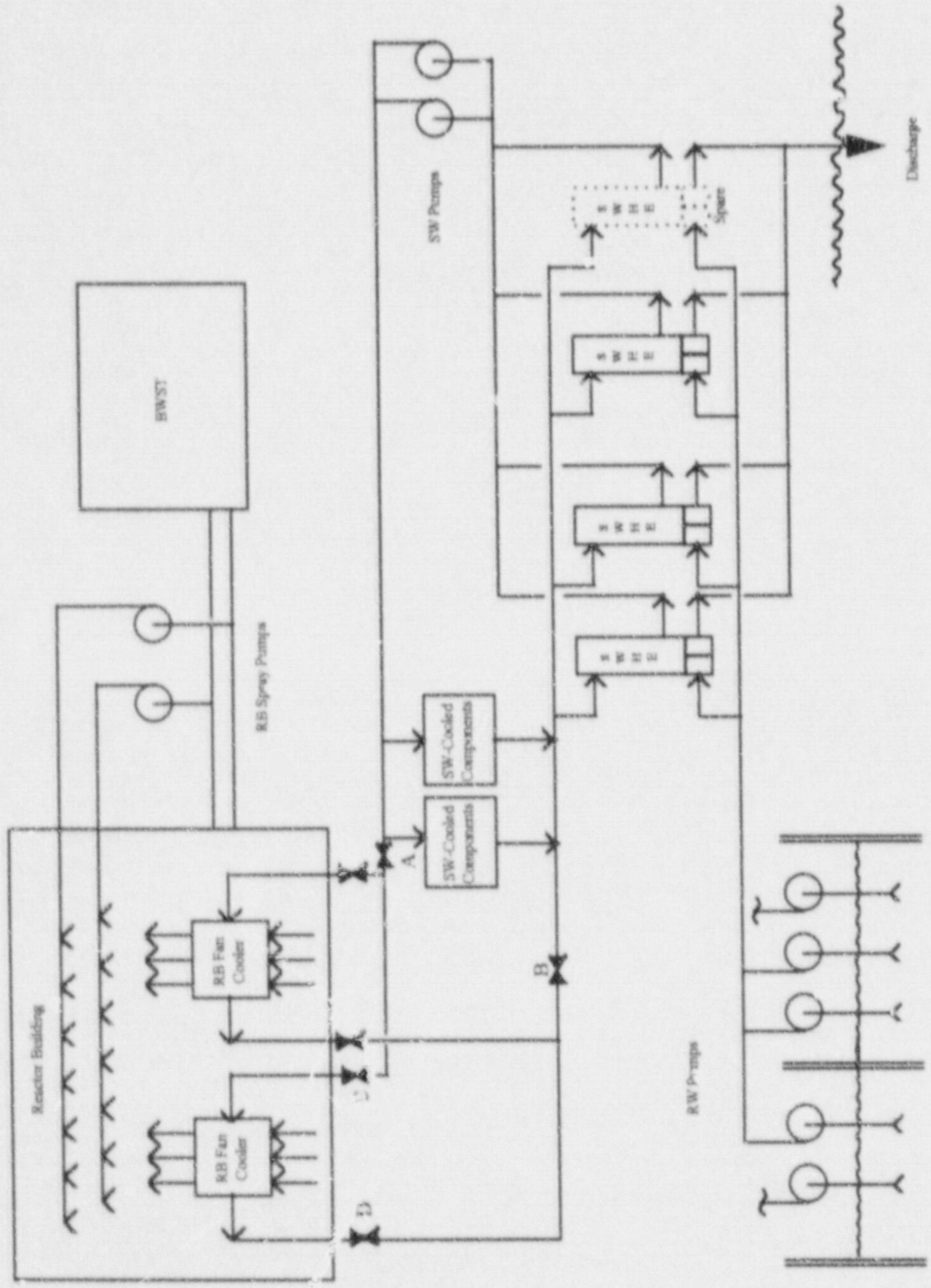
REACTOR BUILDING FAN
STARTING LOGIC MODIFICATION

ATTACHMENT D

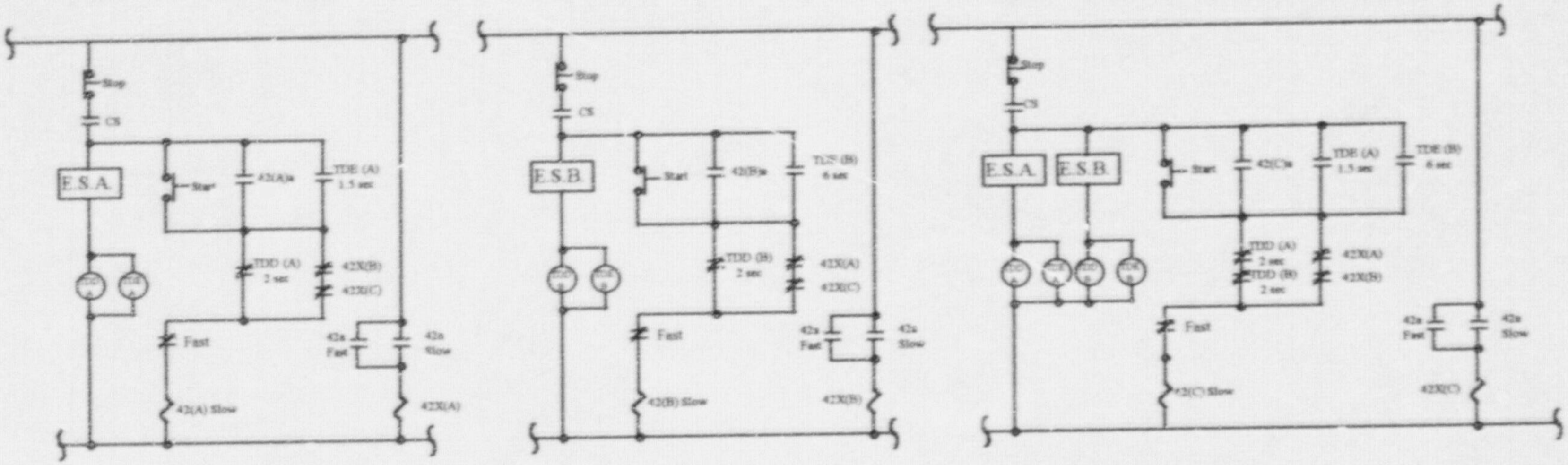
RB Fan SW/RW Sketch
RB Fan Starting Logic Sketch



RB Fan Coolers and SW/RW

Figure 1

Figure 2



RB Fan AHF-1A

RB Fan AHF-1B

RB Fan AHF-1C

= CS - ES Select Control Switch

E.S.A. - ES Logic Matrix (Train A)

- Time Delay Energize relay coils

- Time Delay De-energize relay coils

42(A) Slow - RB fan slow speed contactor coil ('A' Fan)

42X(A) - Interlock relay coil ('A' Fan)

LEGEND

Simplified Schematic of New Logic for RB Fans AHF-1A, AHF-1B and AHF-1C