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10 CFR 50.90

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RS-06-031

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Request for a License Amendment to Revise License Basis to Allow Ganged Rod Drive Capability of the Rod Control Management System (RCMS).

In accordance with 10 CFR 50.90, Exelon Generation Company, LLC (EGC) requests an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2 to incorporate the addition of a new accident description in the LSCS Updated Final Safety Analysis Report (UFSAR). The proposed new section of the UFSAR (i.e., Section 15.4.1.3, "Multiple Rod Withdrawal Error on Startup") addresses the potential for a new accident similar to the event described in the current LSCS UFSAR Section 15.4.1.2, "Continuous Rod Withdrawal During Startup." The potential new accident involves multiple rods being withdrawn in error, vice only one rod.

Attachment 1 provides a description and evaluation of the proposed change.

EGC requests approval of the proposed change by January 30, 2007, with the amendment being implemented within 60 days of issuance.

The proposed changes have been reviewed by the LSCS Plant Operations Review Committee and approved by the Nuclear Safety Review Board in accordance with the requirements of the EGC Quality Assurance Program.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," EGC is notifying the State of Illinois of this application for changes to the TS by transmitting a copy of this letter and its attachments to the designated State Official.

Should you have any questions concerning this letter, please contact Mr. John L. Schrage at (630) 657-2821.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15th day of March 2006.

Respectfully,

Joseph A. Bauer
Manager, Licensing

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ATTACHMENT 1
Evaluation of Proposed Change

1.0 DESCRIPTION

Pursuant to 10 CFR 50.90, Exelon Generation Company, LLC (EGC) requests an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station, (LSCS) Units 1 and 2 to incorporate the addition of a new accident description to the LSCS UFSAR (i.e., Section 15.4.1.3, "Multiple Rod Withdrawal Error on Startup"). This proposed license amendment would allow motion of ganged rod groups as part of a new Rod Control Management System (RCMS). Ganged rod motion will allow withdrawal of up to four rods in assigned gangs during startup conditions. This feature will minimize the time that is required to reach power operation; facilitate routine low change of reactivity surveillances (i.e., weekly control rod cycling); and facilitate insertion of up to four rods in assigned groups for rapid power reductions and normal shutdowns.

LSCS is installing a new digital design called the Rod Control Management System (RCMS) that will replace the aging Rod Worth Minimizer (RWM) and the Reactor Manual Control System (RMCS) which is comprised of the Rod Drive Control System (RDCS) and the Rod Position Indication System (RPIS). The current RMCS uses discrete digital electronics and dynamic logic to control rod motion. The replacement RCMS system will be a digital microprocessor-based system. The new system will also incorporate the RWM within the system, eliminating the need for a separate RWM computer. The replacement RCMS system provides for multiple evaluation, comparison and enforcement of all plant rod withdrawal blocks and refueling interlocks. The system is a fully redundant system for all functions including the RWM function and will allow components to be bypassed for maintenance activities. The new system provides for greater reliability than the current system when no components are bypassed and equivalent reliability to the current system for all other possible system configurations.

This RCMS will enforce analyzed control rod withdrawal sequences below the automatic low power setpoint of the Rod Worth Minimizer; will limit the consequences of a Control Rod Drop Accident (CRDA); will execute control rod movement commands by energizing Control Rod Drive (CRD) Hydraulic Control Unit (HCU) Directional Control Valves (DCVs); will block rod motion based on external rod block signals; will monitor the HCU status; will perform testing of the DCV circuits; will enforce the refuel interlocks; and will receive control rod position data (reed switch status) from all 185 control rod Position Indication Probes (PIPs). These same functions are currently performed by the RMCS system. The RWM sequence can be enforced to full power using a soft switch.

In addition to the features described above, the design of the new RCMS provides the ability to move gangs of up to four rods as part of the software design. EGC has completed a Failure Modes and Effects Analysis as well as an evaluation pursuant to 10 CFR 50.59 for the new RCMS system. As part of this 10 CFR 50.59 evaluation, EGC has determined that the new system can be installed without prior NRC approval, with the exception of ganged rod motion capability.

EGC is currently planning to install the replacement RCMS at LSCS, Unit 2 during the Unit 2 eleventh refueling outage, which is scheduled to begin in March 2007. EGC requests approval of the proposed amendment by January 31, 2007 to support the LSCS, Unit 2 Spring 2007 refueling outage. Once approved, the amendment will be implemented on Unit 2 within 30 days of installation of the RCMS, and prior to startup of Unit 2 following the Spring 2007 refuel outage. The amendment will be implemented on Unit 1 within 30 days of installation of the RCMS during the Spring 2008 refuel outage, and prior to startup of Unit 1 following the Spring 2008 refuel outage.

ATTACHMENT 1
Evaluation of Proposed Change

1.1 Reason for Change

Ganged rod drive capability, if available, would reduce operational challenges by reducing the amount of time that the reactor is in the Intermediate and Startup range power levels during startups. These power levels require a heightened level of reactivity management attention and resources. In addition, ganged rod drive capability will enhance SCRAM avoidance by allowing the rapid insertion of CRAM rods (rods specified in analyzed sequences for the purpose of significantly reducing reactor power rapidly) during plant transients, when required.

1.2 Brief Description of Change

The design of the RCMS will allow the operator to select gangs of up to four rods from the pre-approved sequence for rod motion. Ganged rod motion will be allowed in the STARTUP and RUN modes, allowed for insert only in the SHUTDOWN mode, and not allowed in the REFUEL mode. The system will allow or prevent gang motion under the following specific situations:

1. Withdrawal of a gang in the STARTUP and RUN modes will only be allowed when the gang is selected within the pre-approved sequence that is being enforced by the RWM program, running on both RCMS Controllers. This authorization will be cancelled when the reactor power (as sensed by steam flow) exceeds the Automatic Bypass Setpoint for the Rod Block Monitor (this value will nominally be approximately 26% to 28%). If a transient occurs that requires rapid insertion of rods to prevent a SCRAM, a set of CRAM group rods (predefined in the RWM Sequence) can be selected and inserted at any time.

2. Insertion of a gang in the SHUTDOWN mode will be allowed with both or only one RCMS Controller in service. Following an ATWS event, utilization of this capability will reduce the time needed to achieve a cold shutdown condition.

3. Both ganged withdrawal and insertion can be performed at any power level during surveillances where the rods being moved are either fully inserted or fully withdrawn and the movement is at most one even notch.

2.0 PROPOSED CHANGE

The replacement RCMS system design will permit multiple, simultaneous rod withdrawal to occur during startup operation below the Automatic Bypass Setpoint of the Rod Block Monitor (RBM). The current LSCS UFSAR describes a similar event in Section 15.4.1.2, "Continuous Rod Withdrawal During Startup." The potential for a new accident similar to this accident may have been created and must be reviewed. The potential new accident involves multiple rods being withdrawn in error, vice only one rod. EGC has reviewed this new potential accident and has determined that there is no single failure that would cause the uncontrolled withdrawal of ganged rods, and thus the postulated accident is a non-credible event. EGC requests, pursuant to 10 CFR 50.90, NRC review and approval of a proposed revision to the LSCS, Units 1 and 2 UFSAR to incorporate the addition of a new accident description as UFSAR Section 15.4.1.3, "Multiple Rod Withdrawal Error on Startup." Proposed wording for this new UFSAR section is:

15.4.1.3 Multiple Rod Withdrawal Error on Startup

15.4.1.3.1 Identification of Causes and Frequency Classification

The RCMS prevents the operator from selecting and withdrawing an out of sequence group of rods. Therefore, multiple rod withdrawal errors are not considered credible in the startup power range.

The probability of initiating this event alone is considered low enough to warrant its being categorized as an infrequent incident. The probability of further development of this event is extremely low because it is contingent upon the failure of both channels of RCMS, concurrent with selection of an out-of-sequence group of rods, contrary to software protection and station procedures.

3.0 BACKGROUND

The current RMCS instrumentation and controls are being replaced with a new RCMS. The current RMCS system is discussed in the UFSAR primarily from a functional perspective. The replacement system has been evaluated in a Failure Modes and Effects Analysis and the new system is capable of all the UFSAR functional requirements.

The new RCMS has, in addition to the current UFSAR functional requirements, the ability to send simultaneous movement signals to gangs of up to four rods. This is different from any BWR design, except the BWR/6.

While the RCMS that is being installed is not safety-related, it is a primary reactivity control system. There are two accident/transient conditions in the LSCS UFSAR that credit the systems that have been included in the RCMS. These two accident/transient conditions are described in UFSAR Section 15.4.9, "Control Rod Drop Accident" (CRDA) and in UFSAR Section 15.4.1.2, "Continuous Rod Withdrawal during Reactor Startup." The CRDA addresses the decoupling and free fall of a high worth control rod from a fully inserted or intermediate position. The addition of ganged rod motion does not impact or affect this single rod accident.

The "Continuous Rod Withdrawal during Reactor Startup" accident is described in UFSAR Section 15.4.1.2 as a non-credible event. However, UFSAR Section 15.4.1.2 does not address ganged rod motion as part of that accident. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (Reference 1) addresses the evaluation of this accident/transient for ganged rod motion in Section 15.4.1, "Uncontrolled Control Rod Assembly Withdrawal From a Subcritical or Low Power Startup Condition."

In Section 15.4.1 of NUREG-0800, for BWR/6 designs, the NRC reviewed the possibilities for single failures of the reactor control system that could result in uncontrolled withdrawal of control rods under low power startup conditions. The NRC concluded that the requirements of General Design Criteria 10, 17, 20, and 25 had been met, based upon the inclusion in the plant design of a Rod Pattern Control System (i.e., "Rod Block Instrumentation").

As described in NUREG-1434, Revision 3, "Standard Technical Specifications General Electric Plants, BWR/6 Bases," Section 3.3.2.1, "Control Rod Block Instrumentation" (Reference 2), the rod pattern controller, along with operator actions, ensures that, "during start-up conditions, only

specified control rod sequences and relative positions are allowed over the operating range of all control rods inserted to [10]% RTP." The NRC reviewed this system in Reference 1 and found it acceptable because it precluded single failures in the reactor control system that could result in uncontrolled withdrawal of control rods under low-power conditions. The scope of the NRC review included the design features that act to prevent such withdrawals. The review also demonstrated that no single failure would permit an uncontrolled rod withdrawal that could lead to reactivity insertions greater than those routinely encountered during operation.

The following evaluation of the new RCMS system is provided to demonstrate that the RCMS is also designed such that no single failure can cause an uncontrolled ganged rod withdrawal, and thus the NRC evaluation in NUREG-0800, Section 15.4.1 is applicable to ganged rod motion at LSCS.

3.1 Currently Installed System

The currently installed system does not have the capability of moving more than one rod at a time.

3.2 Replacement System

The function of RCMS is to control reactivity. Interlocks from many different sources are incorporated to prevent the spurious movement of control rods. The consequence of improper operator action or the failure of rod block interlocks is a reactor scram.

The replacement system integrates the former RDCS, RPIS, and RWM subsystems into a single RCMS.

RCMS Components

The new RCMS has its primary components mounted in the RCMS Cabinet (H13-P659), the existing RPIS cabinet (H13-P615) and in the main operator's panel (H13-P603). The configuration described below can be seen in summary form on Figure 1.

Two independent channels of the RCMS, each comprised of a RCMS Controller and a RCMS Interface Unit, are located in the RCMS Cabinet. The controllers are microprocessors that will develop the control requirements for the RCMS and send commands to the interface unit. The output of the interface unit will send the command word to the individual HCUs for monitoring and control of rod motion.

Two channels of rod control and the full core map display are located In the Main Control Room (MCR) panel. Each channel of rod control is driven by a 20" touch screen monitor, which sends operator requests to a MCR Controller in the panel's interior.

The RPIS Cabinet is comprised of Probe/MUX cards and File Control Processor Cards that supply the RCMS with rod position information.

All of the assorted components communicate with each other via Ethernet communications protocols. In addition, the Plant Process Computer (PPC) and the Sequence Development Computer are connected to the same Ethernet network.

RCMS Controllers

The RCMS Controllers are the heart of the system, with each controller independently evaluating the input rod position information, the requests from the MCR Controllers, and the external rod control requirements from other plant monitoring systems. The RWM program runs on each RCMS Controller to generate the acceptable rod motions allowed to comply with the active rod sequence.

If rod motion, requested by the MCR Controller, is allowed by the various inputs to the RCMS controller (e.g., Rod Block Monitor, Nuclear Instrumentation, etc.) and by the programmed rod sequence, the RCMS Controller will initiate commands, via Ethernet, to its associated Interface Unit. The RCMS Controllers will perform a Cross-Compare function that compares input and output signals from the two RCMS Controllers to confirm that each controller produces the same output signal when supplied with the same input signal. A Cross-Compare disagreement causes a rod block. This Cross-Compare function is a barrier to ensure proper controller performance. In addition to the Cross-Compare function, the RCMS Controllers are designed with self-test diagnostics that will provide an alarm, and potentially, rod blocks upon recognition of malfunctions.

RCMS Interface Units

The Interface Units provide the internal and external system I/O between the controllers and other plant systems, either directly or via the Power Module, and to the Branch Junction Modules & Transponders within the RCMS. Each Interface Unit communicates with both controllers via Ethernet links, which are used both to pass input information to the controllers and to receive output information from the controllers. Each of the Interface Units include a microprocessor that packages and processes data sent to, or received from, the controllers; performs comparisons of the data from the two controllers; and performs local self-test diagnostics.

During operation, multiplexed rod movement command outputs from the controllers to the transponders are generated independently in each controller and compared independently in each Interface Unit. If a disagreement is detected in either Interface Unit, the signal is not sent to the transponders. If both Interface Units find the command signals to be in agreement, the Interface Units pass the commands on to the transponders and receives the responses (which it passes back to the controller).

MCR Controllers

The MCR Controllers are microprocessor units with Ethernet communications to the RCMS Controllers and the MCR Interface Units, and with direct communication with either the Rod Select Module or the Core Map Display Module. The MCR controllers are designed with self-test diagnostics that will provide an alarm to the operator upon recognition of malfunctions. The MCR Controllers have two functions. One function is a single channel display/touch screen interface with separate independent displays. The second is a dual-channel redundant operator interface/comparison function.

The processing of signals from the Rod Select Module Switches (for rod movement requests) via MCR Controllers is a redundant function in that if the command request from either of the two MCR Controllers sent to both RCMS Controllers is not in agreement, no action will be taken

by the logic in the RCMS Controllers. Both MCR Controllers receive the selected rod and rod driving information from both RCMS Controllers. If either MCR Controller finds either the rod selection or rod driving signals from the two RCMS Controllers to be in disagreement, an alarm is provided on the MCR Controller's associated display. If rod selection is not in agreement, rod selection confirmation is not provided to the MCR Controller's associated display, and a no-rod-selected signal is sent to the associated RBM channel.

MCR Interface Units

The MCR Interface Units provide the internal and external system I/O. Internal I/O is provided between Rod Select Module Switches (for rod movement requests) and the MCR Controllers. External system I/O interfaces the RCMS with the Reactor Mode Switch and the RBM channels for selected rod identification. Each Interface Unit communicates with only one MCR Controller via an Ethernet link. The Ethernet links send Rod Select Module Switch inputs to the MCR Controllers, and receive selected rod identification from the MCR Controllers. The Interface Units include a microprocessor to package and process data sent to or received from the Controllers and to perform local self-test diagnostics.

Rod Select Module and Reactor Mode Switch inputs come in to the MCR Interface Units on isolated inputs using optical isolation methods. The selected rod identification signals to the RBM channels are provided on serial I/O ports similar to those used for the signals from the Interface Units in the RCMS Cabinet to the transponders.

During normal operation, multiplexed selected rod identification outputs from the MCR Controllers to the RBM channels are transmitted separately from the MCR Controllers A & B to the MCR Interface Units A & B, respectively.

Sequence Computer

Reactor Engineering will develop approved Rod Sequences for use in the RCMS on the Sequence Computer and will then upload these files to the RCMS Controllers using the RCMS Controller interface. This process will only identify gangs for motion when they are evaluated for reactivity effects. Up to four sequences can be loaded in the RCMS at one time. The selection of a sequence is controlled under password security.

3.3 Movement of a Rod Gang

There are a series of requirements that must be satisfied to enable motion of a rod gang.

1. Withdrawal of a gang in the STARTUP and RUN modes will only be allowed when the gang is selected within the pre-approved sequence that is being enforced by the RWM program, running on both RCMS Controllers.

2. For any rod motion, the hand buttons on the MCR panel need to be touched by the operator, which will send two independent signals, one to each MCR Interface unit. Each MCR Interface Unit will send the command to its MCR Controller. The MCR Controller signals the RCMS Controllers, which echo back the command to the MCR Controller for display. The Cross-Compare features in the RCMS Controllers prevent faulty switch contacts initiating rod motion.

3. The RWM, operating on each RCMS Controller, computes withdraw and insert permissive signals for each rod in the core. Thus, if a gang is selected, the RWM and RCMS will still compute each rod's motion requirements as an individual rod. The RWM determines if a rod can be moved, based on the step of the approved sequence that the RWM expects the rods to be in (e.g., the "latched" step). Withdraw and insert permissives are removed from all selected rods on both RCMS Controllers if the RWM detects a gang selected and either:

    i. The rod selected is not in the active sequence step;

    ii. For withdraw only, an RCMS Controller is not in OPERATE (e.g. the RCMS Controller switch is in either BYPASS or TEST), or there is a critical self-test fault;

    iii. There is a Withdraw or Insert Error (e.g. a rod not within target limits for the latched step); or

    iv. A Gang is selected, and not all gang rods are within the latched step.

4. The final withdraw and insert permissive for each rod from the RWM, to each RCMS Controller, is then subjected to additional logic to ensure that:

    i. Gang withdrawal is not permitted above the Automatic Bypass Setpoint of the RBM; and

    ii. Gang withdrawal is not permitted when the RWM is bypassed or unavailable on either RCMS Controller.

If all of the restrictions of the RWM and RCMS are met for a gang of rods, then both RCMS Controllers will transmit movement commands for all the individual rods in the rod gang to both RCMS Interface Units.

The RCMS Controllers use a Cross-Compare Test to validate that both controllers have independently submitted withdraw and insert permissives for every rod. This prevents a single controller from generating a false movement permissive.

As a second barrier to a single controller error generating movement commands for a gang of rods, each RCMS Interface Unit communicates with both RCMS Controllers via Ethernet links, which are used both to pass input information to the Controllers and to receive output information from the controllers. Each RCMS Interface Unit will do a comparison of the input data from the RCMS Controllers and will prevent rod motion commands from being sent to the Transponder cards if the controller inputs disagree.

Beyond the above, there are three other cases where gang movement is allowed. These are:

1. CRAM Group Movement

    When the Active Sequence has designated a CRAM group, the operator can enter the CRAM Mode of movement. In this mode, the operator can select a gang of rods from

the CRAM group and insert them while one of the controllers or Interface Units is bypassed at any power level.

Because the gang movement is only in the insert direction to reduce reactor power, insertion with an RCMS Controller in INOP/Test is considered acceptable.

2. ATWS Recovery

When the Mode Switch is in the SHUTDOWN position, the use of gangs is allowed to insert rods that were not inserted when the scram occurred to more effectively achieve sub-critical conditions. Because the mode switch is in SHUTDOWN, any gang of rods can be selected for insertion, after the RWM has been bypassed.

Again, this is an insert only gang motion, thus insertion with an RCMS Controller in INOP/Test is considered acceptable.

3. Surveillance Activity

For two routine surveillances where rods are either not moved or are moved only one notch in a low reactivity area of the core (rods fully withdrawn) group movement is accepted no matter what reactor power to minimize the time necessary to complete the surveillance. These surveillances are:

i. Rod Exercising – Full out rods can be inserted to position 46 and then withdrawn to position 48 (full out) to verify that they are able to be driven. This occurs approximately every seven days. In addition the rods can be given an additional withdraw command at position 48 to verify that the rod does not overtravel.

ii. Flushing – Full out or full In rods will be given a movement command in the direction that will attempt to move them beyond their limit. This will flush CRD water through the mechanism to clean it. As no rod motion is expected this can be done in gangs.

In either surveillance, the only method of performing the maintenance will be to enter a specific rod select screen on the Rod Control Module. These two screens will allow their respective surveillance activity to occur using gangs, but will not allow any other rod motion. Upon exiting these control screens, all previous RWM and RCMS logics will be reapplied.

4.0 TECHNICAL ANALYSIS

4.1 Single Failure Analysis

EGC has conducted the following technical evaluation to determine if the inclusion of a ganged rod motion program function in the RCMS will meet the expectation that a single failure will not result in uncontrolled withdrawal of control rods under low-power conditions, and would thus validate the applicability of the NRC approval described in NUREG-0800, Section 15.4.1 to ganged rod motion at LSCS. If there is no postulated single failure associated with the use of

ganged rod motion that will cause uncontrolled withdrawal of control rods, then the NRC approval cited in NUREG-0800, Section 15.4.1 is applicable to ganged rod motion at LaSalle County Station. The possible single failures selected for evaluation are the following:

- The incorrect selection of a rod gang for withdrawal,
- The selection of a gang when a single rod was to be selected, followed by a movement command,
- Withdrawal of a rod gang when one or more rod block inputs is providing a rod block; and
- The transmittal of a gang movement command when reactor power is above the Automatic Bypass Setpoint of the RBM.

4.1.1 Incorrect Selection of a Rod Gang for Withdrawal

Failures in this category are those that result in the inadvertent selection of a rod gang by the operator, other than the latched step of the active sequence.

The RCMS replacement system includes controls, displays, and logic to allow the operator to select and drive in or out pre-defined "gangs" of from 2 to 4 control rods. To select a gang, the following conditions must be met:

1. The RWM program must be operational on both RCMS Controllers and neither RCMS is in BYPASS for the current power range. The withdraw-permissive for a GANG selection would not be allowed to occur with any Controller or Interface Unit bypassed or unavailable; and

2. The gang must be defined in the active rod sequence that was uploaded from the Sequence Computer into the RWM and activated by the operator in the RCMS. This activation of the rod sequence by the operator will be independently verified. This ensures that:

    i. Only the correct rod sequence is uploaded and activated, and

    ii. Only gangs that are in the active rod sequence (e.g. those that have been evaluated for their reactivity effects) can be selected. If no sequence is active, then no gangs can be selected.

4.1.2 Selection of a Gang when a Single Rod was to be Selected, Followed by a Movement Command

Failures in this category are those that result in a rod withdrawal command being transmitted to the transponder of multiple rods when only one rod was expected to move. This type of activity would require that the following steps occur simultaneously in both RCMS Controllers:

1. Each RCMS Controller receives a "GANG" command from the MCR Controller for the selected rod

The GANG command to the RCMS Controllers could only be generated by the operator incorrectly selecting "GANG" on the Rod Select Display. The occurrence of this is not likely, as the operator and a second, independent and qualified individual will be required to verify that the selected rod is correct, thus ensuring that a rod gang has not been incorrectly selected. If the operator selects "GANG," the full core display will indicate that all of the rods in a gang have been selected.

2. Each RCMS Controller Identifies that the RWM is Operating on both RCMS Controllers

   The RWM must be operational on both RCMS Controllers, or a withdraw-permissive for a GANG selection would not be allowed to occur. If the RWM is faulted on either RCMS Controller, then only one of the controllers would allow the GANG command, and the RCMS Controller Cross-Compare function would detect the error between controllers, which would prevent transmission of movement commands to the RCMS Interface Units.

3. Each RCMS Controller identifies that there was a gang associated with the latched step of the RWM and the selected rod was in that step.

   If an incorrect GANG signal were sent to the RWM, the RWM would require that there be a gang associated with the latched sequence. This restricts any ganged activity to rods that could move as a gang without undue reactivity concerns.

4. Each RCMS Controller identifies that core power is less than the RBM Automatic Bypass Setpoint.

   If either of the steam flow signals from Reactor Instrumentation indicates that reactor power is greater than the Automatic Bypass Setpoint of the RBM, then the withdraw-permissive for any gang-selected rod will not be allowed.

5. Each RCMS Controller must pass both the RCMS Controller Cross-Compare test and RCMS Interface Unit Check Functions.

   The RCMS Controller Cross-Compare will prevent transmittal of any rod motion commands to the RCMS Interface Units that are not in agreement for both RCMS Controllers. If the controller Cross-Compare does not prevent transmission of differing rod motion commands to the Interface Units, each Interface Unit independently performs a check of the received data from both Controllers. A disagreement of the check of rod motion commands by either Interface Unit will prevent transmittal of rod movement commands to the Transponders.

4.1.3 Withdrawl of a rod gang when one or more rod block inputs is providing a rod block

Failures in this category are those that result in a rod movement command, primarily a rod withdrawal command, being sent to the transponder, when one or more rod block inputs indicate that a rod block should be applied.

In both the current and replacement system, the transponders must receive a dynamically coded signal so that a rod movement command (or ganged rod movement command in the replacement system) must be continuously received, and each signal must have certain data bits reversed in a particular combination. In the replacement RCMS system, the logic to

generate these dynamically changing signals resides only in the RCMS Interface Units. Each RCMS Controller will transmit a rod ID and motion type (i.e., insert, withdraw, etc.) message to the corresponding RCMS Interface Unit. Each RCMS Interface Unit will then generate the dynamic command signal and pass the command signal on to the transponder, only if the rod ID and motion type signals from each RCMS Controller agree. Therefore, in the new RCMS system, a rod can be withdrawn or inserted in conflict with a rod block only if both RCMS Controllers generate identical rod ID and motion type signals.

In the current system, a failure of the single channel input into the RWM could allow a rod withdrawal or rod insertion when a rod block should be applied, concurrent with an operator error. However, in the replacement RCMS system, the RWM logic is integrated into each of the RCMS Controllers and would not allow a rod ID and motion type signal to be sent to the RCMS Interface if the sequence did not allow it, so no single failure will negate the RWM rod block logic.

In both the existing system and the new RCMS system, the non-RWM rod block inputs are redundant. However, in the current system, if core conditions are at a transition point, the inputs to one Activity Control Section could be showing a rod block, while the corresponding inputs to the second Activity Control Section do not (e.g. where APRMs indicate very slightly different power, but near a rod block setting). If the input to the existing system's Activity Control Section that should be providing a rod block is failed, the rod block input may not be applied. However, this condition could only occur in a very narrow range of power, a range where the rod block is not actually necessary. In the new RCMS system, all rod block inputs normally enter both channels of RCMS, so that no single failure of any input will result in omission of a rod block input from the logic, regardless of how close the plant parameter is to the rod block setting. When one RCMS Controller or one RCMS Interface Unit is bypassed, all external plant inputs will still be included in the rod block logic.

Both the RCMS Controllers and the RCMS Interface Units include automatic self-test logic to assure that all functions in the processors continue to operate normally. When a logic routine ceases, a watchdog timer will trigger reset and alarms. All communications interfaces in the RCMS, including the RCMS Controller/RCMS Interface communication links, include data validation logic and loss-of-signal detection logic. Consequently, the receiving end of a communication link will be able to detect the loss of updated inputs. When an RCMS Interface detects loss of input from the RCMS Controller, the RCMS Interface will cease transmitting any rod movement command signals to transponders. Therefore, in the new RCMS system, a rod or rod gang can be withdrawn or inserted in conflict with a rod block only if both RCMS Controllers generate identical erroneous command signals.

4.1.4 Transmittal Of A Gang Movement Command When Reactor Power Is Above The RBM Automatic Bypass Setpoint

Failures in this category are those that result in a rod withdrawal command being sent to the Transponder of multiple rods when gang motion is not allowed by the design. This type of activity would require that both RCMS Controllers have the following occur:

1. The steam flow signal from the Reactor Instrumentation would incorrectly indicate that power was below the Automatic Bypass Setpoint when it was not.

Because both RCMS Interface Units receive steam flow signals from the Reactor Instrumentation, both RCMS Controllers have access to the information. A failure of one of the signals to the Interface Units or the failure of one of the Interface Units to properly process the input information would result in conflicting data sent to the RCMS Controllers. This conflicting data would be caught by the Cross-Compare functions of the controllers and the check function of the Interface Units, preventing rod motion;

or

2. The RWM Bypass switch is not functioning, which could result in the bypass of the RWM without impacting the logic that allows or disallows gang motion.

   This is not a credible event, as it would require more than a single failure, as there are independent contact inputs to each MCR Interface Unit. Additionally, if the RWM on one or both controllers is bypassed, then no gang withdrawals could occur.

4.1.5 Conclusion

The EGC technical evaluation (i.e., described above in 4.1.1 through 4.1.4) indicates that there is no postulated single failure that would cause the uncontrolled withdrawal of ganged rods, and thus the postulated accident is a non-credible event. Moreover, the NRC review and approval in NUREG-0800, Chapter 15.4.1 is applicable to the implementation of ganged rod motion at LSCS.

4.2 Common Mode Software Failure in the RCMS Programming

This evaluation did not review common mode failure of the software as this was considered to be a non-credible event by the rigor employed in the design process and through the Verification and Validation (V&V) of software development. All software and firmware were developed and tested using General Electric's NUMAC Software Control Program (References 3 and 4), which has been reviewed and approved by the NRC for development of safety-related software.

EGC has independently validated the software and firmware and is observing validation testing to ensure effective development. In addition, EGC has hired a third party independent reviewer to conduct an independent audit of the software process which will be completed concurrent with completion of factory verification and acceptance testing

4.3 Evaluation of Low Power Control Rod Error with Ganged Rod Control

Although the analysis summarized in 4.1.1 through 4.1.4 indicates that an uncontrolled ganged rod withdrawal error under low-power conditions at LaSalle County Station is a non-credible event, EGC has also conducted a one-time evaluation of a postulated ganged rod withdrawal error to evaluate the potential impact of this accident upon specified fuel design limits, relative to the Acceptance Criteria in NUREG-0800, Chapter 15.4.1, Items 2.a and 2.c.

This evaluation (Reference 5) indicates that in the event a gang is erroneously withdrawn out-of-sequence, the result will not challenge the fuel integrity. As such, the impact of the non-credible event, with respect to fuel design limits (i.e., Minimum Critical Power Ratio, Linear Heat Generation Rate, uniform cladding strain, and peak pin enthalpy), is within the Acceptance Criteria of NUREG-0800, Chapter 15.4.1, and is bounded by the spectrum of other analyzed accidents for LSCS.

5.0 REGULATORY ANALYSIS

5.1 NO SIGNIFICANT HAZARDS CONSIDERATION

According to 10 CFR 50.92(c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated; or

2. Create the possibility of a new or different kind of accident from any accident previously evaluated; or

3. Involve a significant reduction in a margin of safety.

In support of this determination, an evaluation of each of the three criteria set forth in 10 CFR 50.92 is provided below regarding the proposed license amendment.

1. **The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.**

   The proposed change involves the implementation of an option in a new Rod Control Management System (RCMS) at LaSalle County Station (LSCS), Units 1 and 2, that will move ganged groups of two to four control rods simultaneously. This is a new function that does not impact any initiators or precursors of previously analyzed accidents. The ganged rod movement function does not impact the failure of any plant structures, systems, or components. The proposed change does not have a detrimental impact on the integrity of any plant structure, system, or component that initiates an analyzed event. Nor does the proposed change affect any active or passive failure mechanisms that could lead to an accident.

2. **The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.**

   The proposed change involves the implementation of an option in a new RCMS at LSCS that will allow the movement of ganged rod groups of two to four control rods simultaneously. The current LSCS UFSAR describes a similar event in Section 15.4.1.2, "Continuous Rod Withdrawal During Startup." The potential for a new accident similar to this accident may have been created. Exelon Generation Company, L.L.C. (EGC) has conducted a technical evaluation of this potential accident and has determined that it is a

non-credible event based on the number of components that would be required to fail for the event to occur.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP) (Reference 1) addresses the evaluation of this accident/transient in Section 15.4.1, "Uncontrolled Control Rod Assembly Withdrawal From a Subcritical or Low Power Startup Condition." In NUREG-0800, Section 15.4.1, for BWR-6 designs, the NRC concluded that the requirements of General Design Criteria 10, 17, 20, and 25 had been met, based upon the inclusion in the plant design of a Rod Pattern Control System (i.e., "Rod Block Instrumentation") which precluded the possibility for any single failure of the reactor control system that could result in uncontrolled withdrawal of control rods under low power startup conditions.

As described in NUREG-1434, Revision 3 "Standard Technical Specifications General Electric Plants, BWR/6 Bases," Section 3.3.2.1, "Control Rod Block Instrumentation" (Reference 2), the rod pattern controller, along with operator actions, ensures that, "during start-up conditions, only specified control rod sequences and relative positions are allowed over the operating range of all control rods inserted to [10]% RTP." The NRC reviewed this system in Reference 1 and found it acceptable because it precluded single failures in the reactor control system that could result in uncontrolled withdrawal of control rods under low-power conditions. The scope of the NRC review included the design features that act to prevent such withdrawals. The review also concluded that no single failure would permit an uncontrolled rod withdrawal that could lead to reactivity insertions greater than those routinely encountered during operation.

The EGC technical evaluation indicated that there is no single failure that could cause the uncontrolled withdrawal of ganged rods, and thus the postulated accident is a non-credible event. Moreover, the NRC review and approval in NUREG-0800, Section 15.4.1 is applicable to the implementation of ganged rod motion at LaSalle County Station.

Based on this evaluation, which confirms that the potential new accident is a non-credible event, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. **The proposed change does not involve a significant reduction in a margin of safety.**

   The proposed change involves the implementation of an option in a new RCMS system that will move ganged groups of two to four control rods simultaneously. This is a new function that does not alter any existing setpoints at which protective actions are initiated and no new setpoints or protective actions are introduced. The design basis and operation of the replacement system remains unchanged. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above evaluation, EGC concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c).

5.2 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

5.2.1 10 CFR 50 Appendix A, "General Design Criteria for Nuclear Power Plants"

In NUREG-0800, Section 15.4.1, "Uncontrolled Control Rod Assembly Withdrawal From a Subcritical or Low Power Startup Condition," the NRC evaluated the use of the ganged rod motion system for BWR/6 designs to assure conformance with the requirements of 10 CFR 50 Appendix A, General Design Criteria 10, 17, 20, and 25.

The NRC review found the system acceptable because it precluded single failures in the reactor control system that could result in uncontrolled withdrawal of control rods under low-power conditions. The scope of the NRC review included the design features that act to prevent such withdrawals. The NRC review also concluded that no single failure would permit an uncontrolled rod withdrawal that could lead to reactivity insertions greater than those routinely encountered during operation.

The EGC technical evaluation of this system at LSCS validated that the NRC approval described in NUREG-0800, Section 15.4.1 for ganged rod movement in BWR/6 designs is applicable to the implementation of ganged rod motion at LSCS.

Criterion 10, "Reactor Design"

The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

The ganged motion function of RCMS is not a safety-related activity and has no additional interaction with the safety related portion of the reactivity control system. The above analysis has shown that the only accident or anticipated operational occurrence that ganged rod motion could be credited with has such a low probability of occurrence that it is not considered a credible event. Thus the RCMS use of ganged control rod motion meets Criterion 10.

Criterion 17, "Electric Power Systems"

An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.

The electric power to the RCMS is provided by uninterruptible power sources and covers more of the electronics than the older RMCS system. The loss of power to the RCMS will prevent any control rod motion, including gang motion, with the exception of the SCRAM function. Thus, the RCMS use of ganged control rod motion meets Criterion 17.

Criterion 20, "Protection System Functions"

The protection system shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety.

The RCMS ganged rod function was designed such that unintended ganged rod withdrawal would be prevented. The system design is such that the probability of the potential accident/anticipated operational occurrence is low enough to make the uncontrolled withdrawal of control rods under low-power conditions a non-credible event. Thus the RCMS use of ganged control rod motion meets Criterion 20.

Criterion 25, "Protection System Requirements for Reactivity Control Malfunctions"

The protection system shall be designed to assure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal (not ejection or dropout) of control rods.

The proposed change involves the installation of a new control system that will move ganged groups of two to four control rods simultaneously. Multiple rod withdrawal in the new RCMS system has been evaluated and determined to be a non-credible event based on the number of components that would be required to fail for the event to occur. Based upon this evaluation, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated and thus will not exceed fuel design limits. Thus the RCMS use of ganged control rod motion meets Criterion 25.

5.2.2 10 CFR 50.36, Technical Specifications

EGC has evaluated the new RCMS system, including the implementation of ganged rod movement, considering Criterion 3 of 10 CFR 50.36(c)(2)(ii) and has determined that no additional Limiting Conditions for Operation (LCO) are required in the LSCS Technical Specifications (TS). This evaluation is provided below.

In the current system design at LSCS, control rod patterns during startup conditions are controlled by the operator and the Rod Worth Minimizer (RWM), so that only specified control rod sequences and relative positions are allowed over the operating range of all control rods inserted to 10% RTP. The sequences effectively limit the potential amount of reactivity addition that could occur in the event of a Control Rod Drop Accident.

LSCS TS 3.1.6, "Rod Pattern Control," requires that in Modes 1 and 2, with thermal power less than or equal to 10%, operable control rods shall comply with the requirements of the analyzed rod position sequence. In addition, TS 3.3.2.1, "Rod Block Instrumentation," specifies the LCO, Applicability, Actions, and Completion Times for the RWM. Since the RWM is a system designed to act as a backup to operator control of the rod sequences, only one channel of the RWM is available and required to be operable in Modes 1 and 2 when thermal power is less than or equal to 10%.

The replacement RCMS system will be a digital microprocessor-based system and will incorporate the RWM within the logic of the system, eliminating the need for a separate RWM computer. The replacement RCMS system provides for multiple evaluation, comparison, and enforcement of all plant rod withdrawal blocks and refueling interlocks.

The system is a fully redundant system for all functions, including the RWM function, and will allow components to be bypassed for maintenance activities. The new system provides for greater reliability than the current system when no components are bypassed and equivalent reliability to the current system for all other possible system configurations. As such, the current Applicability and LCOs for Rod Pattern Control (i.e., TS 3.1.6) and the Rod Worth Minimizer (i.e., TS 3.3.2.1) bound the new system design.

With respect to ganged rod motion, EGC has determined that the postulated accident associated with ganged rod motion, Multiple Rod Withdrawal Error on Startup, is a non-credible event, and as such, the current Applicability and LCOs for Rod Pattern Control (i.e., TS 3.1.6) and the Rod Worth Minimizer (i.e., TS 3.3.2.1) bound the new operational configuration.

6.0 ENVIRONMENTAL CONSIDERATION

EGC has evaluated this proposed operating license amendment consistent with the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments." EGC has determined that this proposed change meets the criteria for categorical exclusion set forth in paragraph (c)(9) of 10 CFR 51.22, Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," and as such, has determined that no irreversible consequences exist in accordance with paragraph (b) of 10 CFR 50.92, "Issuance of amendment." This determination is based on the fact that this change is being processed as an amendment to the license issued pursuant to 10 CFR 50, Domestic Licensing of Production and Utilization Facilities." which changes a requirement with respect to installation or use of a facility component located the restricted area, as defined in 10 CFR 20, Standards for Protection Against Radiation," or which changes an inspection or surveillance requirement and the amendment meets the following specific criteria:

(i) The amendment involves no significant hazards consideration.

As demonstrated in Section 5.1 above, "No Significant Hazards Consideration," the proposed change does not involve any significant hazards consideration.

(ii) There is no significant change in the types or significant increase in the amounts of any effluent that may be released offsite.

The proposed change involves movement of ganged control rods. The proposed change does not result in an increase in power level, does not increase the production nor alter the flow path or method of disposal of radioactive waste or byproducts; thus, there will be no change in the amounts of radiological effluents released offsite.

Based on the above evaluation, the proposed change will not result in a significant change in the types or significant increase in the amounts of any effluent released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed change involves the movement of ganged control rods. The proposed change will not result in any changes to the previously analyzed configuration of the facility. There will be no change in the level of controls or methodology used for the processing of radioactive effluents or handling of solid radioactive waste, nor will the proposal result in any change in the normal radiation levels in the plant. Therefore, there will be no increase in individual or cumulative occupational radiation exposure resulting from this change.

7.0 REFERENCES

1. NUREG-0800, Standard Review Plan, Chapter 15.4.1, "Uncontrolled Control Rod Assembly Withdrawal from a Subcritical or Low Power Startup Condition"

2. NUREG 1434, Revision 3, BWR/6 STS, B 3.3.2.1, "Control Rod Block Instrumentation"

3. GE 23A5162, NUMAC Software Management Plan Revision 2, April 10, 2000

4. GE 23A5163 NUMAC Software Verification and Validation Plan Revision 2, August 10, 1995

5. Framatome ANP: SWJ:05:014, "Low Power CRWE Evaluation for LaSalle," October 31, 2005

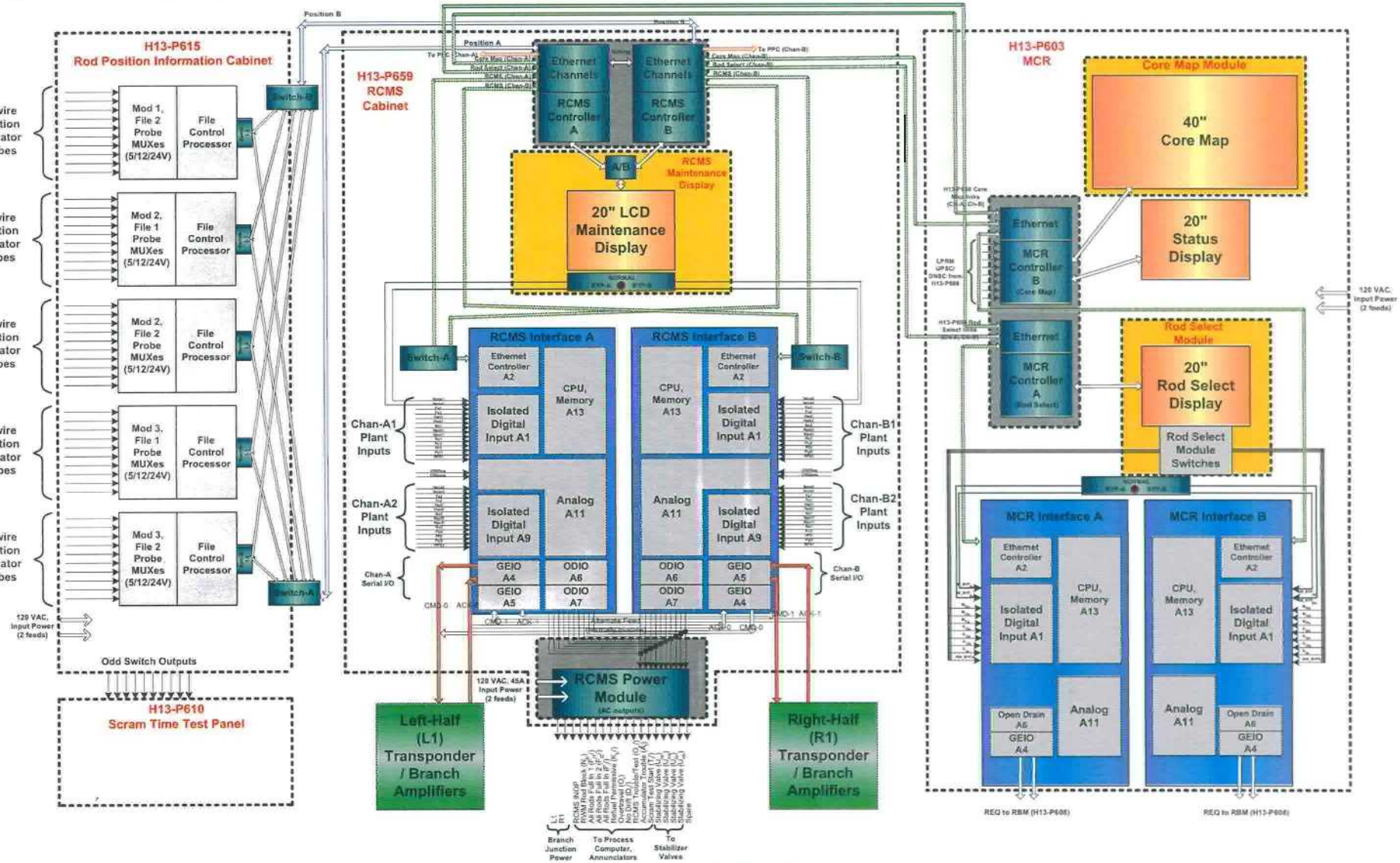

Figure 1, RCMS Block Diagram