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U. S. Nuclear Regulatory Commission
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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 License Amendment to Allow Ganged Rod Drive Capability of the Rod Control Management System

References:

1. Letter from J. A. Bauer (Exelon Generation Company, LLC) to U. S. NRC, "Request for a License Amendment to Revise License Basis to Allow Ganged Rod Drive Capability of the Rod Control Management System (RCMS)," dated March 15, 2006

2. Letter from J. A. Bauer (Exelon Generation Company, LLC) to U. S. NRC, "Supplemental Information Concerning License Amendment Request to Revise License Basis to Allow Ganged Rod Drive Capability of the Rod Control Management System (RCMS)," dated May 10, 2006

3. Letter from J. A. Bauer (Exelon Generation Company, LLC) to U. S. NRC, "Supplemental Information Concerning License Amendment Request to Revise License Basis to Allow Ganged Rod Drive Capability of the Rod Control Management System (RCMS)," dated June 1, 2006

4. Letter from K. R. Jury (Exelon Generation Company, LLC) to U. S. NRC, "Withdrawal of License Amendment Request to Revise License Basis to Allow Ganged Rod Drive Capability of the Rod Control Management System (RCMS)," dated July 31, 2006

5. NRC Memo, "Summary of September 19, 2006, Pre-Application Meeting with Exelon Generation Company, LLC, with Respect to Additional Information Regarding License Amendment Request for Ganged Rod Withdrawal (TAC Nos. MD0360 and MD0361)," dated November 28, 2006

6. NRC Memo, "Summary of January 26, 2007, Pre-Application Meeting with Exelon, for Ganged Rod Withdrawal and Ultimate Heat Sink Amendment Denial," dated March 12, 2007

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In Reference 1, as supplemented by References 2 and 3, Exelon Generation Company, LLC (EGC) requested an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2. The proposed change would have revised the licensing basis to allow ganged rod drive capability of the Rod Control Management System (RCMS). Subsequently, in Reference 4, EGC withdrew the proposed license amendment, and stated that it will be resubmitted at a later date.

On September 19, 2006, and January 26, 2007, pre-application meetings were held between the NRC and EGC. The purpose of the pre-application meetings was to discuss plans for resubmittal of the proposed license amendment, and to discuss the technical aspects of the request to identify the specific scope and level of detail of information needed to support the resubmittal. In References 5 and 6, the NRC issued summaries of the pre-application meetings.

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," EGC requests an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LSCS, Units 1 and 2, to revise the current licensing basis for Section 15 of the LSCS Updated Final Safety Analysis Report (UFSAR). The proposed change incorporates the description of a new, potential accident into the LSCS 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. Information requested by the NRC during September 19, 2006, and January 26, 2007, pre-application meetings is documented in References 5 and 6, and is included in this resubmittal.

This request is subdivided as follows.

- Attachment 1 provides a description and evaluation of the proposed change.
- Attachment 2 contains GE-Hitachi Nuclear Energy Americas LLC (GEH) documents supporting the proposed change.

Attachment 2 contains information considered proprietary to GEH. Therefore, EGC requests that the information be withheld from public disclosure in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (a)(4), and 10 CFR 9.17, "Agency records exempt from public disclosure," paragraph (a)(4). An affidavit attesting to the proprietary nature of this information is included in Attachment 3.

The proposed change has 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.

EGC plans to install the new RCMS on Unit 1 during the Spring 2008 refueling outage, and on Unit 2 during the Spring 2009 refueling outage. EGC requests approval of the proposed change by August 14, 2008. Once approved, the amendment will be implemented on each unit within 60 days if the modifications are completed, or prior to startup from the refueling outage during which the modifications are completed. This implementation period will provide adequate time

for the affected station documents to be revised using the appropriate change control mechanisms.

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

There are no regulatory commitments contained in this letter. If you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 14th day of August 2007.

Respectfully,

Darin M Benyak

Darin M. Benyak
Director, Licensing

Attachments:
1. Evaluation of Proposed Change
2. GE-Hitachi Nuclear Energy Americas LLC Documents Supporting the Proposed Change (PROPRIETARY INFORMATION)
3. GE-Hitachi Nuclear Energy Americas LLC Affidavit

ATTACHMENT 1
Evaluation of Proposed Change

1.0 DESCRIPTION

1.1 Intent of License Amendment Request

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," 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 revise the current licensing basis for Section 15 of the LSCS Updated Final Safety Analysis Report (UFSAR).

The proposed change incorporates the description of a new, potential accident into the LSCS 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.

This change is the result of a planned modification that will provide the capability of ganged rod movement. Ganged rod motion will allow withdrawal of up to four rods in assigned gangs during startup conditions and insertion of rod gangs at all times. 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.

1.2 Need for License Amendment

EGC is replacing the original 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) with a new Rod Control Management System (RCMS). 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, but 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 new RCMS will perform the following functions that are currently performed by the RMCS system:

i. Enforce analyzed control rod withdrawal sequences below the automatic low power setpoint of the RWM;

ii. Limit the consequences of a Control Rod Drop Accident (CRDA);

iii. Execute control rod movement commands by energizing Control Rod Drive (CRD) Hydraulic Control Unit (HCU) Directional Control Valves (DCVs) and stabilizing valves;

iv. Block rod motion based on external rod block signals;

v. Monitor the HCU status;

vi. Perform testing of the DCV circuits;

vii. Enforce refuel interlocks; and

viii. Receive and display control rod position data (reed switch status) from all 185 control rod Position Indication Probes (PIPs).

In addition to the functions described above, the software design of the new RCMS provides the ability to move gangs of up to four rods under certain conditions.

A Failure Modes and Effects Analysis, as well as an evaluation pursuant to 10 CFR 50.59 for the new RCMS system, have been completed. The Failure Modes and Effects Analysis was previously submitted to the NRC as Attachment 2 to Reference 1. As part of the 10 CFR 50.59 evaluation, EGC has determined that NRC review and approval is necessary to implement ganged rod motion capability, since the proposed activity creates a possibility for an accident of a different type than any previously evaluated in the LSCS UFSAR.

EGC plans to install the new RCMS on Unit 1 during the Spring 2008 refueling outage, and on Unit 2 during the Spring 2009 refueling outage. However, ganged rod motion capability will not be enabled until NRC approval is received. EGC requests approval of the proposed change to allow ganged rod motion capability by August 14, 2008. Once approved, the amendment will be implemented on each unit within 60 days if the modifications are completed, or prior to startup from the refueling outage during which the modifications are completed. This implementation period will provide adequate time for the affected station documents to be revised using the appropriate change control mechanisms, as well as support development and implementation of training, operation, and maintenance plans.

1.3 Reason for Proposed 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 and shutdowns. 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 (i.e., rods specified in analyzed sequences for the purpose of significantly reducing reactor power rapidly) during plant transients, when required.

The software 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 is only allowed if all components of RCMS are not bypassed, the RWM is not bypassed, and power is below the automatic bypass setpoint of the Rod Block Monitor (RBM). Ganged rod motion will be allowed in Modes 1 and 2 (i.e., Power Operation and Startup), allowed for insert only in the Modes 3 and 4 (i.e., Hot Shutdown and Cold Shutdown), and not allowed in Mode 5 (i.e., Refueling). The system will also allow or prevent gang motion under specific operational situations.

2.0 PROPOSED CHANGE

Currently, the LSCS UFSAR describes an event in Section 15.4.1.2, "Continuous Rod Withdrawal During Startup," that involves a single control rod being withdrawn in error. This event is characterized as an infrequent incident based on the low probability of the event.

The new RCMS system will permit multiple, simultaneous rod withdrawal (i.e., ganged rod withdrawal) during startup operation below the automatic bypass setpoint of the RBM. As part of the 10 CFR 50.59 evaluation for the new RCMS system, EGC has determined that NRC review and approval is necessary to implement ganged rod drive capability, since the proposed activity creates a possibility for an accident of a different type than any previously evaluated in the LSCS UFSAR. The potential new accident is similar to the event described in UFSAR Section 15.4.1.2, except that the potential new accident involves multiple rods being withdrawn in error, vice only one rod.

EGC has reviewed this new potential accident with respect to equipment, software, and human system interface, and has determined that the probability of initiating this event is low enough to warrant categorization as an infrequent incident, similar to the event described in UFSAR Section 15.4.1.2. Therefore, in accordance with 10 CFR 50.90, EGC requests NRC review and approval of a proposed revision to the LSCS, Units 1 and 2, licensing basis to incorporate a new accident description as UFSAR Section 15.4.1.3, "Multiple Rod Withdrawal Error on Startup." The proposed wording for this new UFSAR section is provided below.

"15.4.1.3 Multiple Rod Withdrawal Error on Startup

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 TECHNICAL EVALUATION

3.1 Description and Design Basis of Existing RMCS

3.1.1 General System Description

The new microprocessor-based RCMS replaces the existing digital RMCS and RWM. The existing RMCS includes the RDCS and the RPIS. The new RCMS integrates all the design basis functions of the existing RDCS, RPIS, and RWM.

The current RMCS consists of the electrical circuitry, switches, indicators, and alarm devices provided for operational manipulation of the control rods and the surveillance of associated equipment. The system includes the interlocks that inhibit rod movement under certain conditions, which prevent multiple operator errors or equipment malfunctions from requiring the operation of the reactor protection system (RPS). The RMCS does not include any of the circuitry or devices used to automatically or manually scram the reactor. In addition, the system does not include the control rod drives and the control rod drive hydraulic system.

3.1.2 Applicable General Design Criteria (GDC), Safety Classification, and Conformance with Codes and Standards

The existing system is classified as a power generation system and is not safety-related. The RMCS is an operational control system and has no safety function. The existing RMCS instrumentation and controls satisfy the following safety design bases.

a. The circuitry provided for the manipulation of control rods shall be designed so that no single failure can negate the effectiveness of a reactor scram.

b. Repair, replacement, or adjustment of any failed or malfunctioning component shall not require that any element needed for reactor scram be bypassed unless a bypass is normally allowed.

The RMCS is designed to satisfy the following power generation design bases.

a. Inhibit control rod withdrawal following erroneous control rod manipulations so that RPS scram is not required.

b. Inhibit control rod withdrawal in time to prevent local fuel damage as a result of erroneous control rod manipulations.

c. Inhibit control rod movement whenever such movement would result in operationally undesirable core reactivity conditions or whenever instrumentation is incapable of monitoring the core response to rod movement.

d. Limit the potential for inadvertent rod withdrawal leading to RPS action by designing the RMCS in such a way that deliberate operator action is required to effect a continuous rod withdrawal.

e. Provide the licensed operator with the means to achieve prescribed control rod patterns; provide information pertinent to the position and motion of the control rods in the control room.

The RMCS is not required for safety functions, nor required to operate after the design-basis accident. The system is only required to operate in the normal plant environments for power generation purposes.

The RMCS instrumentation and controls are designed in accordance with the following specific regulatory requirements and industry standards.

GDC 1, "Quality Standards and Records"

The total quality assurance program is described in UFSAR Chapter 17.0 and consists of Topical Report CE-1A. The detailed quality assurance program developed by EGC satisfies the requirements of Criterion 1.

The quality assurance program for LSCS is conducted in accordance with the EGC Quality Assurance Program for Nuclear Generating Stations. This program was initially submitted to the NRC in June 1975, as Topical Report CE-1. By letter dated December 29, 1975, the NRC informed Commonwealth Edison Company (i.e., the predecessor of EGC, and the license applicant at the time) that Topical Report CE-1 was an acceptable program for the design, procurement, construction, and operations activities within Commonwealth Edison's scope of work for nuclear power plants. The NRC approved Revision 70 of Quality Assurance Topical Report EGC-1-A in December 2002.

GDC 13, "Instrumentation and Control"

Adequate instrumentation has been provided to monitor system variables in the reactor core, reactor coolant pressure boundary, and reactor containment. Appropriate controls have been provided to maintain the variables in the operating range and to initiate the necessary corrective action in the event of an abnormal operational occurrence or accident.

GDC 24, "Separation of Protection and Control Systems" and IEEE-Standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Systems"

There is separation between the reactor protection system and the process control systems. Sensors, trip channels, and trip logics of the reactor protection system are not used directly for automatic control of process systems. Therefore, failure in the controls and instrumentation of process systems cannot induce failure in any portion of the protection system. The protection system is separated from the reactor manual control system as required by GDC 24.

GDC 26, "Reactivity Control System Redundancy and Capability"

Two independent reactivity control systems utilizing different design principles are provided. Control of reactivity is operationally provided by a combination of movable control rods, burnable poisons, and the reactor coolant recirculation system flow. These systems accommodate fuel burnup, load changes, and long-term reactivity changes. Reactor shutdown by the control rod drive system is sufficiently rapid to prevent exceeding of acceptable fuel design limits for normal operation and all abnormal operational transients.

The circuitry for manual insertion or withdrawal of control rods is completely independent of the circuitry for reactor scram. This separation of the scram and normal rod control functions prevents failures in the reactor manual control circuitry from affecting the scram circuitry.

The design of the rod worth minimizer system includes appropriate margin for malfunctions such as stuck rods in the event that they do occur. Control rod withdrawal sequences and patterns are selected prior to operation to achieve optimum core performance, and, simultaneously, low individual rod worths. The operating procedures to accomplish such patterns are supplemented by blocking of rod withdrawals that do not conform to the sequence utilized in the RWM system. An additional safety design basis of the control rod system requires that the core in its maximum reactivity condition be subcritical with the control rod of the highest worth fully withdrawn and all other rods fully inserted. Because of the carefully planned and regulated rod withdrawal sequence, prompt shutdown of the reactor can be achieved with the insertion of a small number of the many independent control rods. In the event that a reactor scram is necessary, the unlikely occurrences of a limited number of stuck rods (within the available amount of shutdown margin discussed above) will not hinder the capability of the control rod system to render the core subcritical.

A Standby Liquid Control system containing neutron absorbing sodium pentaborate solution is the independent backup system. This system has the capability to shut the reactor down from full power and maintain it in a subcritical condition at any time during the core life.

Based upon the discussion above, the redundancy and capabilities of the reactivity control systems for LSCS satisfy the requirements of Criterion 26.

3.1.3 Subsystems

The new RCMS replaces the existing RMCS and RWM. The existing RMCS includes the RDCS and the RPIS. The design functions of these subsystems are described below.

RDCS Design Function

The design function of the RDCS is to control the solenoid operated valves that control the drive water path for each control rod. The RDCS also includes the logic circuits for

the rod block trip instrumentation and control system. The design function of the rod block circuitry portion of the existing RMCS is to inhibit movement or selection of control rods based upon receipt of input signals from other systems and subsystems. The rod block logic circuitry is arranged as two trip channels and each logic circuit can provide a separate rod block signal to inhibit rod withdrawal. Rod withdrawal is permitted only if the outputs from the two logic circuits agree at all times.

RPIS Design Function

The design function of the RPIS is to provide information pertinent to the position and motion of the control rods to the licensed operator in the control room. This system includes the rod position probes and the electronic hardware that processes the probe signals and provides the position indication data.

RWM Design Function

The design function of the RWM is to enforce adherence to established startup, shutdown, and power level control rod patterns. The RWM prevents the operator from establishing control rod patterns that are inconsistent with pre-stored sequences by initiating appropriate rod withdrawal block, and rod insert block interlock signals to the RMCS rod block circuitry.

The RWM sequences limit individual control rod worths to acceptable levels, as determined by the design-basis CRDA. The existing RWM has two channels, but only one is selected for use at a time, so it functions as a single channel system. The RWM function can be bypassed and its block function disabled only by specific procedural control initiated by the licensed operator.

3.1.4 Accident Effects

The RMCS circuitry is completely independent (i.e., physically and electrically) of the circuitry controlling the scram valves (i.e., RPS). This separation of the scram and normal rod control functions prevents failures in the reactor manual control circuitry from affecting the scram circuitry. No single failure in the RMCS can result in the prevention of a reactor scram, and the repair, adjustment, or maintenance of RMCS components does not affect the scram circuitry.

The RMCS is not required for plant safety. The system has no function during a loss-of-coolant accident or any design-basis accident. The system is not used for plant shutdown resulting from accident or nonstandard operational conditions.

The function of the RMCS is to control core reactivity and thus power level. Interlocks from many different sources are incorporated to prevent the spurious operation of drives or undesirable rod patterns throughout all ranges of operation.

This system contains no components, circuits, or instruments required for reactor trip or scram. There are no operator manual controls that can prevent scram.

The consequence of improper operator action or the failure of rod block interlocks is an inadvertent reactor scram.

3.2 Description and Design Basis of RCMS

3.2.1 General System Description

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, which was previously submitted to the NRC as Attachment 2 of Reference 1, 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 boiling water reactor (BWR) design prior to the BWR/6.

While the RCMS that is being installed is not safety-related, it is a primary reactivity control system. Chapter 15 of the LSCS UFSAR discusses accident/transient conditions that credit the systems included in the RCMS. These accident/transient conditions are described in UFSAR Section 15.4.9, "Control Rod Drop Accident," UFSAR Section 15.4.1.1, "Control Rod Removal Error During Refueling," UFSAR Section 15.4.2, "Rod Withdrawal Error – at Power," and 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 affect this single rod accident.

The Control Rod Removal Error During Refueling event considers an arbitrary full withdrawal of the most reactive control rod during refueling. This event is not affected by the addition of ganged rod motion since RCMS prevents ganged rod motion in Mode 5.

The Rod Withdrawal Error at Power event assumes that while operating in the power range in a normal mode of operation, the reactor operator makes a procedural error and continuously withdraws the maximum worth control rod until the RBM inhibits further withdrawal. This event is not affected by the addition of ganged rod motion since RCMS prevents ganged rod motion above the automatic bypass setpoint of the RBM.

The Continuous Rod Withdrawal during Reactor Startup event is described in UFSAR Section 15.4.1.2 as an infrequent incident, based solely upon the low probability of initiating causes for the 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," (i.e., Reference 2) addresses the evaluation of this event 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 GDC 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 (i.e., Reference 3), Section 3.3.2.1, "Control Rod Block Instrumentation," 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 2 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 Section 15.4.1 of NUREG-0800 for ganged rod motion at a BWR/6 is also applicable to ganged rod motion at LSCS.

3.2.2 Comparison of New RCMS to Existing RMCS

The existing RMCS does not have the capability to move more than one rod at a time; whereas, the new RCMS has ganged rod capability. 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 new RCMS integrates the former RDCS, RPIS, and RWM subsystems into a single system. The implementation of the new RCMS will retain all of the system-level functions of the existing RMCS and RWM, as well as add additional capabilities. The replacement system is classified as non-safety-related, and has been designed to the same regulatory criteria and standards as the existing system. RCMS system inputs remain functionally unchanged and outputs are compatible with the interfacing systems.

The primary physical equipment difference between the existing RMCS and the replacement RCMS is that the existing RMCS uses digital Transistor-Transistor-Logic (TTL) electronics (i.e., no microprocessors) for the logic, and discrete indicators (i.e., light emitting diodes or incandescent) for operator information. The replacement RCMS uses microprocessor controllers for logic and liquid crystal display (LCD) flat-panel touch screen displays for operator information.

The use of the flat-panel touch screen displays instead of the discrete indicators creates a fundamental change to the human system interface. The graphical interfaces were developed in accordance with a Human Factors Engineering (HFE) program. This HFE

program utilized a methodology consistent with current industry and regulatory standards and guidelines described in NUREG-0700, "Human-System Interface Design Review Guidelines" (i.e., Reference 4). Because of the possible impact of the fundamental change in the way the information is presented to the operator, EGC has evaluated and approved this change in accordance with 10 CFR 50.59, "Changes, tests, and experiments." A copy of GE Nuclear Energy Specification 26A6518, "RCMS Human System Interface Specification," is provided in Attachment 2.

In the current system, the "full-core display" does not include actual rod position, other than full-in or full-out, and is limited to the fixed indicators. There is no method to indicate abnormal or special conditions for the rod. The replacement system uses a computer-driven LCD display, providing the capability to display information specific to the plant condition and to provide the operator with available system information to allow more effective evaluation of abnormal conditions. The display provides high resolution viewing of information from normal operator positions within the MCR front panel area.

The new RCMS can also be operated with any combination or all of the following components inoperable or bypassed. RCMS will prevent rod motion if any component becomes inoperable, until the inoperable component is bypassed. It should be noted that the system does not allow ganged withdrawal with one or more RCMS components bypassed.

- One RCMS Controller;
- One MCR Controller;
- One RCMS Interface Unit; or
- One MCR Interface Unit.

Because of the possible impact of taking portions of the normally dual channel RCMS to "single channel" status, which is different from the existing RMCS, EGC has evaluated and approved this change in accordance with 10 CFR 50.59.

Half of the existing Neutron Monitoring System (NMS) monitors provides inputs to one of the existing RMCS rod block logic circuits, and the other half provides inputs to the other RMCS rod block logic circuit. Both channels of the replacement RCMS will receive all of the NMS inputs. Providing all the NMS inputs to both channels does not create an adverse change to the system interfaces, since the two NMS channels remain separated within the NMS. The required rod block logic is maintained by the new RCMS. The new RCMS design maintains two separate logic channels as required for the rod block circuitry.

As is the case with the existing RMCS and RWM, the components for the replacement RCMS are not safety-related or seismic, but are seismically installed in the cabinets and panels to satisfy seismic II/I concerns, where required.

3.2.3 RCMS Components

The new RCMS has its primary components mounted in the RCMS Cabinet (H13-P659) and the existing RPIS cabinet (H13-P615), which are located in the Auxiliary Electric

Equipment Room (AEER), and in the main operator's panel (H13-P603) in the Main Control Room (MCR). The configuration described below can be seen in summary form in Section 3.2.4 on Figure 1 and Figure 2.

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 Units. The output of an Interface Unit will send a 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 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 (FCP) 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.

3.2.3.1 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 (e.g., Rod Block Monitor, Nuclear Instrumentation, etc.). 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, as well as rod blocks when appropriate, based on the significance of the self-test failure.

3.2.3.2 RCMS Interface Units

The Interface Units provide the internal and external system input/output (I/O) between the controllers and other plant systems, and to the Branch Junction Modules and 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 includes 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 Branch Junction Modules and the HCU 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 Controllers.

3.2.3.3 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.

3.2.3.4 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 and B, to the MCR Interface Units, A and B, respectively.

3.2.3.5 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.

3.2.4 Internal Communication and Data Interfaces

Figure 1 provides a simplified diagram that outlines the communication flow paths between components located in the field (i.e., rod position switches, HCU transponders, and branch junction modules) and RCMS components in the AEER.

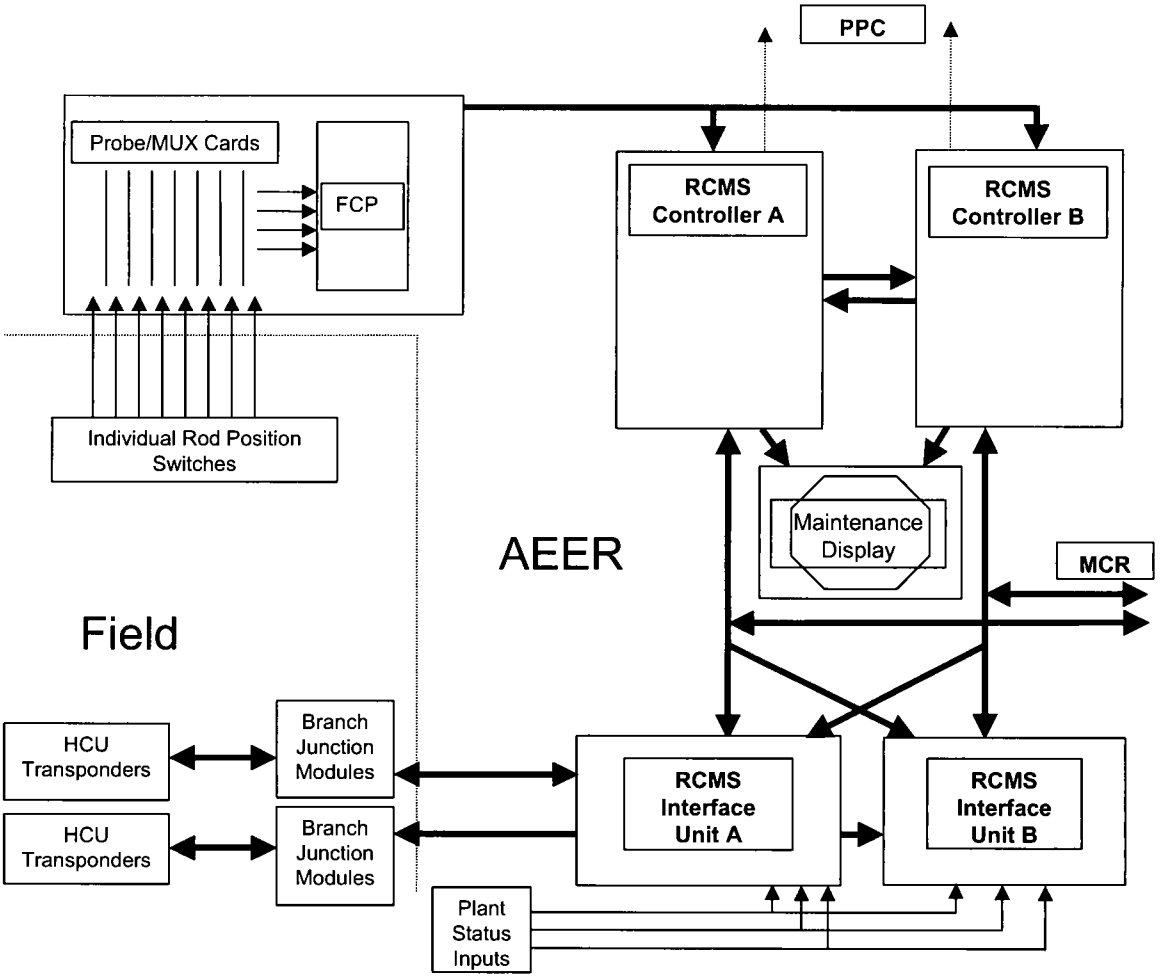


Figure 1: Communication Flow Paths Between RCMS Components

Communication within and external to RCMS is comprised of fixed-field data words that are sent between the various elements. Failure of the data word to verify its checksum will generate a self-test fault. Included in the format are the internet protocol (IP) of the sending device and a checksum for the data word. The basic flow of data and commands is as follows.

Every five milliseconds each rod position is obtained from the appropriate Probe/MUX card and then transmitted to both redundant RCMS Controllers via Ethernet. This message is a fixed length coded message. This information is decoded in the RCMS Controllers. The rod position information is used by the controllers as specified in the RCMS Performance Specification (i.e., GE Nuclear Energy Specification 26A6515, "RCMS/MCR Controller Performance Specification"). A copy of this specification is included in Attachment 2.

The HCU Transponder Card for each rod's HCU receives input signals from the RCMS Interface Unit. These signals are transmitted to the HCU as a COMMAND word and the reply from the HCU is via an ACKNOWLEDGE word. The composition of the COMMAND word is a fixed word format, but the format varies based on the activities that are being performed. Activities include rod motion, monitoring, self-test and scram timing.

The RCMS Interface Units also receive digital inputs from various circuitry that generate Rod Blocks external to the RCMS. Digital signals for other bypasses and information points that are used are also inputted. In addition, several analog signals are inputted for use in data collection based on activities. All of these signals (i.e., described in GE Nuclear Energy Specification 26A6530, "RCMS and MCR Interface Performance Specification") are processed by the Interface Units and placed in the digital words transmitted by the Interface Units. A copy of GE Nuclear Energy Specification 26A6530 is included in Attachment 2.

The redundant RCMS Interface Units communicate with both redundant RCMS Controllers. The Interface Units supply the data recovered from the plant to the controllers for use in evaluating rod motion and rod blocks. The Controllers provide the command signals for rod motion and tests and calibrations. The Interface Units compare the inputs from both Controllers and will block any actions from the Controllers that do not agree.

The RCMS Controllers are the primary computational units of the system. The Controller generates the commands for various rod motion functions and various surveillance actions, as well as operate the RWM. The RCMS Controllers communicate with each other and both conduct cross comparisons of their output signals. If the cross compare checks fail action is blocked from the Controllers. The RCMS Controllers communicate via Ethernet with the Interface Units, the Plant Process Computer, the Sequence Generation Computer, and the MCR Controllers.

RCMS Panel H13-P659 also includes a 20-inch maintenance display with touchscreen that is connected to an A/B selector switch. The maintenance screen has a limited set of requests available to prevent selection or movement of control rods. Either channel of the RCMS Controller can be selected from the maintenance display. Normal maintenance activities are provided through the design of custom touchscreen displays. A keyboard and mouse/trackball may also be connected.

Figure 2 provides a simplified diagram that outlines the communication flow paths between RCMS components in the MCR.

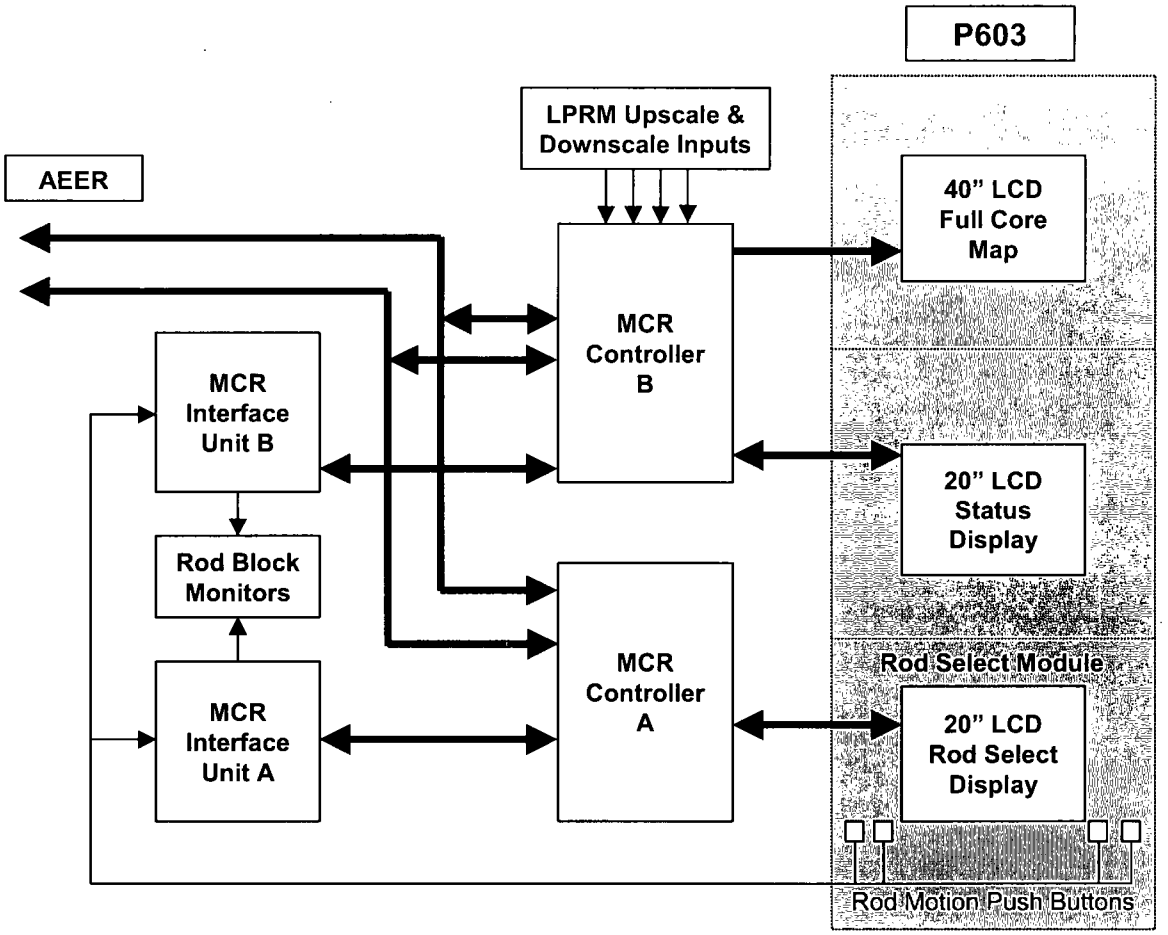


Figure 2: Communication Flow Paths Between RCMS Components in the MCR

In the MCR the operator interface is comprised of three LCD display screens – one is the 40-inch full core map and the other two are 20-inch touch activated screens for monitoring and control. These displays are controlled by the MCR Controllers (i.e., one for the full core display and one 20-inch display, and one for the other 20-inch display). These MCR controllers are responsible for the graphic user interfaces and for transmitting requests to the RCMS Controllers.

Each MCR Controller communicates with a MCR Interface Unit. These Interface Units accept digital inputs from the various control switches on the operator's panel for rod motion and control. In addition, the Interface Unit communicates with the RBMs to provide the rod selected for the RBM to use. Basic communications patterns include rod movements and external rod blocks.

Rod Movement

When the RWM is not bypassed, a rod to be moved will need to be in the correct sequence. When the RWM is bypassed, ganged rod withdrawal is not allowed. The

actions associated with active sequence upload, selection, activation, and selection of a rod gang from the active sequence are described in Section 3.3.

To get the sequence, the Reactor Engineer will upload a sequence from the sequence computer through the PPC to both RCMS Controllers. The operator must select the sequence to be used and activate it from the MCR Rod Select 20-inch screen. This activity is password-protected.

On the 20-inch rod select screen, the operator can now select a rod by touching the rod button on the screen. Positive feedback of selection will occur by a change in color, to green, on the button. If an out-of-step rod for the sequence is selected, the collar will turn white, indicating that the rod cannot be moved. The selected rod information is sent to the RCMS controller where it echoes the rod number back to the MCR Controller, to the RBM for nulling and to the PPC for display. The POSITIONS screen on the second 20-inch display screen will receive the RCMS selected rod echo and display the selected rod in a separate display insert on the 20-inch screen (i.e., the separate display insert is shown in Attachment 2 on Sheet 53 of GE Nuclear Energy Specification 26A6518).

The operator then can use the pushbuttons on the MCR Rod Select Panel (i.e., hard-wired mechanical switches not software switches) to start rod motion. When the MCR Interface detects the switch change, it sends the signal to the MCR Controller, which then sends the signal to both RCMS Controllers. Each RCMS Controller applies applicable rod motion logic to determine if the rod will move. If the logic has established a withdraw or insert block, or if it identifies the rod as being at a position where it cannot move in the requested direction, no action will occur. If the rod can move, then a permissive is generated and the motion command is sent to the RCMS Interface Units.

All commands and data base changes in the RCMS Controllers are cross-compared with the other controller. Any cross-compare failures generate a fatal flaw and set the controller to INOPERABLE.

Each RCMS Interface Unit compares the inputs from both RCMS Controllers, and if there is a disagreement no action is taken. If the data from both RCMS Controllers agree, then each Interface Unit generates a COMMAND word for the action and transmits it to the Branch Junction Modules and Transponder cards.

The applicable Transponder card will respond and start the designated action.

External Rod Blocks

Each RCMS Interface Unit will receive a rod block generated by an external system (e.g., Scram Discharge Volume High Instrument Volume). Both channels of the external rod block are sent to each Interface Unit. If either input changes (i.e., an OR logic), the Interface Unit sends a rod block signal to both RCMS Controllers.

The RCMS Controllers will input the rod block signal into rod motion logic to prevent motion when appropriate. The Controllers will also send the rod block signal to the MCR Controllers for display.

3.2.5 External Communication Interfaces

RCMS Access Control and Cyber Security

The electronic information assets of the RCMS will be protected from unauthorized access, disclosure, modification, and destruction in accordance with EGC policy, IT-AC-1, "Corporate Information Technology (IT) Policy," and procedure IT-AC-551-1, "Access Control." These controls comply with the guidance provided in Nuclear Energy Institute (NEI) 04-04, Revision 1, "Cyber Security Program for Power Reactors" (i.e., Reference 5).

Physical Security

All RCMS components are located in areas with physical access control measures in place (i.e., Security Badge readers and/or locked doors). Access to these areas requires not only a Security Badge that enables access to the station's Protected Area, but also specific authorization to enter the station's Vital Areas. Approval to enter these areas can only be obtained by individuals who have a need to access these areas.

External Connections and Cyber Security

The EGC electronic access controls for the RCMS employ a graded approach, with multiple levels of control (i.e., Defense-in-Depth). Figure 3 provides a simplified network diagram depicting the successive interconnections and security controls between the RCMS Controllers, other RCMS Components, the PPC network, the EGC Nuclear Business Unit Local Area Network (LAN), the EGC Wide Area Network (WAN), and the Internet.

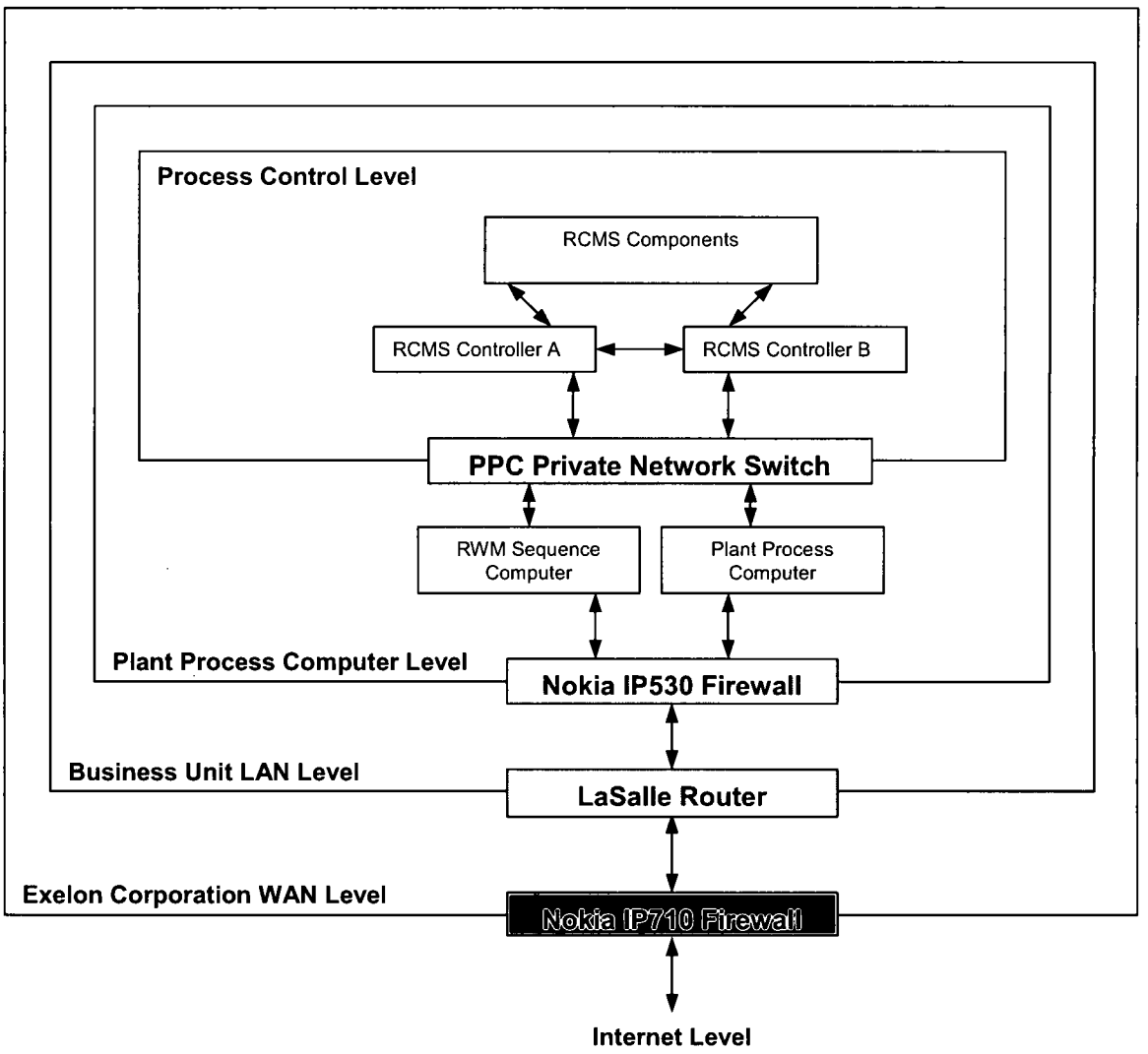


Figure 3: RCMS External Network Diagram

The first or innermost level in Figure 3 is the Process Control Level. The RCMS resides in this level, along with other typical local control systems (i.e., those systems that employ a Programmable Logic Controller system that enables access to, and control of the systems, as well as acquire control system data).

All RCMS components, with the exception of the RCMS Controllers, are connected to each other via a dedicated private network, with no direct connection to the higher level networks. Each RCMS Controller is connected to both the PPC (i.e., the second level in Figure 3) and the RWM Sequence Computer via dedicated connections to the PPC network. These connections provide bi-directional messaging capabilities between the systems; no access to RCMS control functions (i.e., through the 20-inch MCR touchscreens and MCR Controllers) is directly available via these links.

All PPC components and the RWM Sequence Computer are located behind the LSCS PPC Firewall. The PPC Firewall is a Nokia IP530 appliance running Checkpoint v5.4 software. Connections through the Firewall, to the PPC and RWM Sequence Computer from the EGC Nuclear Business Unit LAN are controlled via a unique UserID and Password.

The EGC Nuclear Business Unit LAN and the Exelon WAN (i.e., the third and final levels in Figure 3) are protected by a Nokia IP710 Firewall platform running Checkpoint v5.5 software. Access to assets on the Exelon LAN/WAN, through this final Firewall, from the Internet also requires both a two-factor authorization (i.e., individual PIN and SecurID Token) and a unique UserID and Password.

Access privileges from outside the Exelon WAN to the PPC and RWM Sequence Computer through both the Internet and PPC Firewalls are provided to a limited group of individuals (i.e., typically the station Reactor Engineers and IT System Administrators). Access to these systems requires the user to first gain access to the Exelon LAN/WAN and then gain access to specific devices behind the PPC firewall using both two-factor authorization and a unique UserID and Password for the protected system.

The Exelon firewalls are designed to allow access only to those machines that are specifically authorized by the firewall rule bases. All unauthorized network access attempts will be rejected and logged by the firewall.

A Cyber Security risk assessment was recently completed at LSCS in accordance with NEI 04-04 and NUREG/CR-6847 (i.e., Reference 6) for all site Critical Digital Assets, including the proposed design for RCMS. The proposed RCMS design was ranked as Very Well Protected, with a susceptibility level of 2, a risk category of B-4, and was deemed an Acceptable Risk with no design-related mitigation required. As a result of EGC's NEI 04-04 Cyber Security reviews, it was determined that intrusion detection software should be added to all company firewalls as a general mitigating action. This will add an additional level of security to existing firewalls by providing an early warning of potential external attacks. The schedule for this additional enhancement has not been finalized; however, implementation is currently scheduled to occur in 2008.

3.2.6 Description of the Qualification of RCMS Components and Equipment

The RCMS is a complete replacement and upgrade of the RMCS, RWM, RPIS, and the Operator interfaces that support the systems.

Four basic components of the system were upgraded to support the new RCMS. These are:

- RMCS HCU Transponder Cards,
- RMCS Branch Junction Modules,
- RPIS Probe/MUX Cards, and
- RPIS FCPs.

The Transponders, Branch Junction Modules, and Probe/MUX cards were added to the current product line and documented as upgraded replacements. A new specification (i.e., GE Nuclear Energy Specification 26A6616, "File Control Processor Performance Specification") was developed for the FCP, which is provided in Attachment 2.

The remaining components are new designs based on specifications for this project. Some of these products are based on similar products in GE's NUMAC+ product line. These components are:

- RCMS and MCR Controllers – Containing Pentium-M controllers, power supplies and Ethernet data links
- RCMS and MCR Interfaces – Containing Digital and Analog Inputs, power supplies and Ethernet data links
- Power Module – Distribute output power as directed by the Interface Units.
- Display Screens – NEC LCD displays driven by the MCR Controllers. The twenty-inch screens have a touch-screen input system installed.

Attachment 2 contains copies of GE Nuclear Energy performance and requirements specifications for the RCMS components.

Although the system, equipment, and software are not safety-related, EGC has implemented an electromagnetic compatibility (EMC) qualification test plan for analysis of the new RCMS (NUMAC and GE equipment) to meet the design specification. The specification requires "No EMI/RFI [Electromagnetic Interference/Radio Frequency Interference] interaction with other plant systems. This includes both emissions and susceptibility."

The EMC test plan will include EMC mapping to ensure that the RCMS digital upgrade is not susceptible to ambient EMI/RFI. EMC measurements will be acquired in accordance with EPRI TR-102323, Revision 2, "Guidelines for Electromagnetic Interference Testing Power Plant Equipment," and a comparative analysis will be implemented for RCMS hardware components against prior EMC qualifications for similar NUMAC and GE equipment. Note that over 600 NUMAC instruments are in operation around the world, with 20 years of experience. Most of this product line has undergone EMC testing per EPRI TR-102323. There has been no evidence of NUMAC instruments interfering with other instruments. Similarly, there is no evidence that other plant equipment has interfered with NUMAC instruments.

The comparative analysis will consider each category of electromagnetic interference described in EPRI TR-102323 to determine additional testing requirements. This data will then be reviewed to determine if the RCMS envelops the LSCS environment.

In Reference 1, EGC provided information that addressed how the touch screen was qualified and dedicated, how inadvertent movement via an unintended touch screen would be prevented, and relevant information from a human factors review. The rod movement control switches in the new RCMS (i.e., the push buttons that are used by the operator to withdraw and insert a control rod) are similar to the same components in the current system (i.e., electromechanical push buttons) and provide identical functionality.

The 20-inch touchscreen monitor will replace the current Rod Select Matrix. The current system is equipped with individual mechanical push buttons for each control rod.

The touchscreen displays indicate that the operator's finger is over a selectable softkey by a change in color border (i.e., appearance that the softkey is depressed). Softkeys are selected when the finger is over the softkey and released from the touchscreen. Rod motion commands are provided via the rod movement control switches, which are independent of the touchscreen. Thus, inadvertent movement of a control rod or gang cannot result solely from the unintended touch of a touchscreen.

With respect to a human factors review, the graphical user interface screens for the LSCS RCMS were developed under an HFE program that defined the information, controls, and alarms for controlling and monitoring the RCMS. Although the RCMS has no safety-related functions, the following codes, standards, and guidelines were used as the basis for the HFE analysis that was performed for this system.

- Institute of Electrical and Electronics Engineers (IEEE) Standard 1023 -1988, "IEEE Guide to the Application of Human Factors Engineering to Systems, Equipments and Facilities of Nuclear Power Generating Stations."

- International Electrotechnical Commission (IEC) Publication 964, "Design for Control Rooms of Nuclear Power Plants, 1989."

- NUREG-0700, Revision 2, "Human-System Interface Design Review Guideline."

- NUREG-0711, "Human Factor Engineering, Program Review Level."

- NUREG-0800, Revision1, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Chapter 18, "Human Factor Engineering."

- NUREG/CR-3331, "A Methodology For Allocating Nuclear Power Plant Control Functions to Human and Automated Control."

The RCMS and components have been built to the GE Nuclear Energy Quality Assurance Program, NEDO-11209-04A, Revision 8, dated March 31, 1989, which has been reviewed and accepted by the NRC. This program meets the requirements of ANSI N45.2, and 10 CFR 50, Appendix B.

In accordance with this Quality Assurance Program, GE will issue a Product Quality Certification (PQC) for all products delivered for the RCMS system. The PQC will confirm that all products comply with the applicable specifications, drawings, codes, and standards.

3.2.7 Description of Software Development and Testing, and Characterization of Common-Mode Software Failure Probability

The software for the new RCMS modification at LSCS has been developed by both EGC and GE. Software for the RCMS project is not required to be safety related as the whole

system is completely non-safety related in function. However, since the RCMS is used for reactivity control, the software for the system is being developed using processes designed to develop safety related software.

The EGC-developed software consists of the Sequence Builder and Sequence Transfer applications. These two applications were developed in accordance with EGC procedures IT-AA-101, Revision 4, "Digital Technology Systems (DTS) Quality Procedure" and IT-AA-101-1000, "DTS Quality Assurance Level Classifications." These procedures establish the quality assurance requirements needed to ensure that the appropriate degree or level of testing, verification, and validation is addressed. The process that is defined by these procedures provides a graded approach to DTS quality in a manner commensurate with the risk impact that an application could have on nuclear safety. As such, EGC has classified both applications as "Regulatory Related." This classification is applied to applications that are required by regulations, or whose failure to operate as expected will have an indirect effect on nuclear plant safety.

The EGC-developed software, with the exception of the Sequence Builder and Sequence Transfer applications, does not affect the RCMS process and thus will not be discussed further. The Sequence Builder and Sequence Transfer programs will be treated as "Class BB software" (i.e., Regulatory Related) in accordance with EGC's software development program procedures.

The software on the RCMS equipment was developed using the GE NUMAC Software Configuration Management Plan (SCMP), the NUMAC Software Management Plan (SMP), and the NUMAC Software Verification and Validation Plan (SVVP) process, as modified in GE Nuclear Energy DRF 0000-0038-3006, Revision 2, "Rod Control Management System (RCMS) Software Development Plan," dated March 9, 2007. A copy of GE Nuclear Energy DRF 0000-0038-3006 is provided in Attachment 2. The GE NUMAC software process is GE's standard safety-related software development process. This process has been submitted to the NRC multiple times and has been accepted for use in safety-related software. The most recent approval was for the Power Monitoring system for Susquehanna station in 2006.

The RCMS Software Development Plan establishes the software verification and validation process that was implemented by GE for all software-based components of the LSCS RCMS modification. The plan identifies specific software-related deliverables that were produced during each phase of the project, and establishes certain review criteria, for each software related deliverable, for the purpose of providing guidance in the preparation, review, and approval of these items.

The RCMS Software Development Plan specifically addresses issues such as design control, change control, documentation, record keeping, independent verification, and software development requirements, as described in RG 1.152, "Criteria for Digital Computers in Safety Systems of Nuclear Power Plants." For the RCMS software, the development process is comprised of six stages, called baselines, which are listed below along with a brief description from the software development plan.

Baseline 1 – Definition and Planning

This design phase comprises the identification and confirmation of all top-level requirements applicable to the LSCS RCMS Project, including contractual and licensing commitments. Included in this phase is confirmation of applicability of the standard NUMAC Software Plans.

Baseline 2 – Product Performance Definition

This phase covers the basic instrument design of all the major RCMS components, including the hardware design, hardware/software allocation of functions, and user interface design and communication protocol definition for communication links with external systems such as the Plant Process Computer.

Baseline 3 – High Level Software Design

This phase provides for the high level design of the software, including the architecture and structure, definition of individual software modules, functional allocation to software modules and operating priorities, as well as communication protocol definition for internal communication links between the various RCMS components.

Baseline 4 – Coding and Module Test

This phase covers the detailed software design, coding and module testing. Verifications done in this phase include code reviews of all software. All modules are code reviewed. Code review verifications are conducted and documented where the output of the verification is a single source file or multiple source files identified by filename and PVCS version number. Module testing, as described in NUMAC SMP Section 2.4.3, is performed at the discretion of the software developer, to the extent required to provide the developer with a high level of confidence that the code is performing as it should. No formal module test documentation (i.e. Module Test Data Sheets) is required at this phase. However, if a functional requirement cannot be tested in a "black box" test environment (Validation Test) and can only be tested in a "white box" test environment during this phase, then the Software Functional Test Report must include documentation of the "white box" testing that was performed in order to demonstrate compliance with the functional requirement.

Baseline 5 – Integration Test

This phase provides for the integration of the functional software, the display software and the target hardware, as well as integration of the various instruments within the system. This testing may be done using emulators and other special tools that allow confirmation of individual software functions within the instruments (white box testing). Any necessary software design changes will be finalized within this phase. Integration testing, as described in NUMAC SMP Section 2.5.1, is performed at the discretion of the software developer, to the extent required to provide the developer with a high level of confidence that the code is performing as it should.

Upon completion of the testing a Software Functional Test Report is prepared by the software developer. The Software Functional Test Report is a summary report of all "white box" testing performed by the software developer during the Module Test phase and the Integration Test phase in order to formally document the module testing and integration testing activities. Supporting data, such as emulator trace printouts, screen printouts, and other pertinent test data is referenced in the test report. If a functional requirement cannot be tested in a "black box" test environment, then the Software Functional Test Report must include documentation of the "white box" testing that was performed in order to demonstrate compliance with the functional requirement.

Baseline 6 – Validation and Software Release

This phase covers the formal validation testing. Validation testing exercises all functions of the RCMS related to either the hardware interfaces or the user interface (i.e., black box testing). This integrated testing will be performed on the production RCMS hardware, for a combined software Validation and Factory Acceptance Test (VFAT). Upon successful conclusion of this baseline phase, the software (or firmware) will be released for manufacture.

The Baseline 1 and 2 documents contain the complete requirements for the RCMS. Thus, the requirements for the testing of the software are from the baseline one and two documents and the matrix generated from these documents currently holds approximately 2900 specific requirements (however some are duplicates as the same requirements may apply to more than one function).

As part of the NUMAC process, the executable programs of the RCMS and MCR Interface Units will be burned into non-volatile memory for use. The executable programs in the RCMS and MCR Controllers will be held in flash memory and uploaded on boot-up. The final VFAT will be completed using the production equipment and programs that will be installed in the plant. This SVVP process ensures that the probability of a common mode failure of the software for those functions tested, while not quantifiable, is low enough to warrant categorization as an infrequent incident.

In addition to the EGC and GE software Verification and Validation (V&V) processes, EGC has contracted Process Design Consultants, Inc. (ProDesCon) to act as an independent third party oversight group to ensure that the development process is not compromised.

Attachment 2 contains copies of the Baseline 1 and 2 documents, NUMAC Software Management Plan, NUMAC Software Verification and Validation Plan, EMC Qualification Test Plan, and RCMS Software Development Plan.

3.2.8 Regulatory Guide 1.97 Applicability

The RCMS will provide the control room operator with control rod position indication. Control rod position indication (full-in) is a Regulatory Guide 1.97 Type B Category 3 variable for verification of reactivity control. LSCS is committed to Revision 2 of Regulatory Guide 1.97 (i.e., Reference 7), as indicated in UFSAR Appendix B,

"Conformance to Regulatory Guides." Therefore the RMCS instrumentation must meet the Category 3 requirements indicated in Section 1.3.3 of Reference 7, which requires high quality commercial grade instrumentation suitable for its environment. The RMCS will meet these requirements.

3.2.9 Emergency Operating Procedures Impact

The new RCMS will provide all the current expected functions for the EOP process. Other than the revised operator interface in the control room there will be no difference in the displays for the EOP required indications. The new RCMS will enhance the information available to the control room for EOP events with better shutdown confirmation information displays. Therefore, RCMS will have no detrimental impact on the EOP process and will provide improved displays.

3.3 Analysis of Potential Single Failures

3.3.1 Overview and Licensing Basis

The Continuous Rod Withdrawal Error (CRWE) event is described in Section 15.4.1.2 of the LSCS UFSAR as an event where the licensed operator, during reactor startup, selects the highest worth rod, out-of-sequence, and withdraws this out-of-sequence rod fully from the core. As stated in UFSAR 15.4.1.2, the probability of initiating causes, or multiple errors, for this event alone is considered low enough to categorize it as an infrequent incident. The probability of further development of the event is extremely low because it is contingent upon the failure of the RWM, concurrent with out-of-sequence rod selection, plus operator non-acknowledgement of continuous alarm annunciations prior to safety system actuation. As such, UFSAR 15.4.1.2 states: "Control rod withdrawal errors are not considered credible in the startup power range."

However, UFSAR Section 15.4.1.2 does not address ganged rod motion as part of that analysis. NUREG-0800 addresses the evaluation of this event 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 GDC 10, "Reactor Design," GDC 17, "Electric Power Systems," GDC 20, "Protection System Functions," and GDC 25, "Protection System Requirements for Reactivity Control Malfunctions," 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 Section 3.3.2.1, "Control Rod Block Instrumentation," of NUREG-1434, the rod pattern controller, along with licensed 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 NUREG-0800 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 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 Section 15.4.1 of NUREG-0800 is applicable to ganged rod motion at LSCS.

There are three major elements that have been evaluated in this single failure analysis: software design, hardware design, and administrative (i.e., "man-in-loop") requirements. Details regarding the hardware design are provided in Section 3.2. Each of these elements contributes to the single fault tolerance of ganged rod withdrawal in the RCMS. These elements are referenced in the analysis of potential single failures. Thus, this analysis addresses the single fault tolerance of the RCMS to demonstrate that the software, hardware, and administrative requirements will reliably provide the sequence control necessary to conclude that gang rod withdrawal errors in the startup power range are of sufficiently low probability to categorize the event as an infrequent incident.

3.3.2 RCMS Software Design Features and Requirements

The design features and requirements of the RCMS software applications that are described below will be used in the evaluation of the probability and severity of a single failure in the software that would allow a potential ganged rod withdrawal error.

3.3.2.1 Installing and Activating a Rod Sequence

In order to add a RWM rod sequence to the RCMS, and activate this sequence, the following software logic steps are required. These logic steps will be validated by the VFAT.

a. The Sequence Builder and Sequence Transfer programs will enforce the Banked Position Withdrawal Sequence (BPWS) rules of the fuel designer, such that there are no excessive reactivity additions due to sequence step configurations. If the BPWS rules would be violated by the sequence, the Sequence Builder program provides a warning to alert the qualified nuclear engineer.

b. When the Sequence Builder program builds a sequence for transfer to the RCMS, it will establish a set of configuration requirements (e.g., sequence identification, number of affected rods, and the total number of steps). The RCMS Controller task for the receipt of sequences will verify the reasonableness of these requirements to ensure that there was no corruption during transfer. This will also include a checksum validation. If these checks are not satisfied, the sequence will be rejected, and a cancellation message will be transmitted to the Sequence Builder program.

c. Once the sequence is validated and transferred to the RCMS, the licensed operator can then select the sequence as the active sequence, as directed by procedure. This action requires password entry. After validation of the password by the RCMS, the licensed operator selects the desired sequence by activating the "MAKE ACTIVE" touch-button when the desired sequence is highlighted, followed by activating the "ACCEPT" touch-button. A second individual (i.e., either a licensed Reactor Operator, Senior Reactor Operator, or Qualified Nuclear Engineer) will then verify the licensed operator's action of selecting an active sequence, in accordance with procedural requirements.

d. The RWM will conduct a sequence latching function when a new sequence is selected. This function will "latch" the RWM at the step in the sequence that has the least sequence errors, based on rod position information. The licensed operator can modify the latched step if there are multiple steps with no errors using the sequence alignment function. This licensed operator action to modify the latched step is controlled and directed by procedure. Once latched at a step, the RWM will only change the latched sequence to an adjacent step.

3.3.2.2 Selection of a Rod Gang from the Active Sequence

Selection of a gang for withdrawal requires the following steps.

a. The RCMS Controller must be enabled to allow gang motion.

   i. The licensed operator must enter a password on a "SET SYSTEM PARAMETERS" screen.

   ii. The licensed operator must change the "GANG MODE" on the SET SYSTEM PARAMETERS screen to "ENABLE," and then accept this using the "ACCEPT" touch-button.

b. The licensed operator then must select the "GANG" mode for motion by activating the "GANG" touch-button on the "SELECT" screen.

c. When the licensed operator touches and releases a rod touch button on the "SELECT" screen, the following process occurs to select each rod in the gang:

   i. The MCR Controller in "CONTROL MODE" sends the selection request to both RCMS Controllers.

   ii. Both RCMS Controllers verify agreement for the selected rod.

   iii. Both RCMS Controllers return the selected rod to MCR Controllers.

iv. The MCR Controller compares both selections. A critical Self-Test error is generated if there is disagreement. This error will prevent selection of a gang for withdrawal.

v. The MCR Controller in "CONTROL MODE" displays rod selection.

d. When a gang is successfully selected, the RWM software will calculate a specific withdraw and insert permissive for each rod in the gang. This calculation requires that the RWM consider the rod to be moveable in either withdraw and/or insert.

e. For a gang withdraw permissive to be in place, all RCMS/MCR Controllers and Interface Units must be operable and not bypassed.

3.3.2.3 Withdrawing a GANG

The following actions are necessary to withdraw a gang of rods that are selected in the latched step.

a. The licensed operator commences gang withdrawal by pressing the "WITHDRAW" button for single notch movement, or simultaneously pressing both the "WITHDRAW" and "CONTINUOUS WITHDRAW" buttons for continuous movement.

b. For each rod in the gang with a withdraw-permissive, the appropriate motion commands are generated and sent to the RCMS Interface Unit. Each rod now has a separate signal. Each rod will stop withdrawal as it approaches the limit of the step of the active sequence.

3.3.2.4 RCMS Interface Routing

For gang withdrawal, each RCMS Interface Unit will take the inputs from both RCMS Controllers and will process the input data words and output command words to the applicable HCU Transponder cards for rod motion through the following actions.

a. Each RCMS Interface Unit will compare the rod motion command words from both controllers. If the command words from the two controllers do not agree, no motion commands are sent to the transponders.

b. The RCMS Interface Unit will generate repetitive command words to the HCU Transponder cards with alternating control bits to direct the appropriate HCU Directional Control Valves to open or close, which will move the rod(s). The alternating pattern will be checked on the HCU Transponder card, which will stop motion if the alternating pattern is not present.

3.3.2.5 Self-Test Monitoring

The Controllers and Interface Units have self-test capabilities that will generate Critical or Non-Critical faults on detection of a variety of checks. A critical fault will generate an RCMS or MCR INOP alarm, which will disable rod motion.

Watchdog timers are in place on all RCMS and MCR Controllers and all RCMS and MCR Interface Units. These are physical timers that, if timed out, will cause the affected unit to restart.

On startup or reboot, the RCMS and MCR Controllers perform program and configuration checksum diagnostics to validate that the executable programs and configurations are correct.

3.3.2.6 Annunciator Alarms

The RCMS Interface Units send discrete digital outputs to the control room annunciator system when the following conditions exist:

- RCMS INOP Alarm,
- RCMS TROUBLE Alarm, and
- Rod Out Block Alarm.

These alarms will trigger plant annunciator alarms when the RCMS identifies errors in the operation of the system. Specifically:

a. RCMS INOP (TROUBLE) alarms identify critical (non-critical) self-test errors that would indicate a controller failure, and

b. The Rod Out Block Alarm will indicate when a rod out block exists and when a withdraw error exists that has been caused by a rod withdrawn outside the limits of the latched step.

3.3.2.7 General Task Function Processing

The RCMS and MCR Controller software operates under the control of an event-driven, real-time, multitasking operating system, which allows the various tasks to be executed in a pseudo-concurrent fashion. A monitoring task also executes periodically, allowing interrupt-driven I/O to interrupt and request services. When a request for service is detected, the monitor task transfers to a specified routine for the requested service. The various routines unique to the RCMS and MCR Controller applications are written in the standard ANSI "C" programming language.

3.3.3 RCMS Man-in-Loop Administrative Controls

The following "Man-In-Loop" controls (i.e., administrative controls required by procedure and implemented by the licensed operator) are used in evaluating the probability and severity of a single failure causing a potential ganged rod withdrawal error.

3.3.3.1 Man-in-Loop Controls for Upload of Active Sequence to RCMS

The addition of a RWM sequence to the RCMS requires the following manual (i.e., procedurally-required and operator-performed) actions.

a. As stated in Section 3.3.2.1, the Sequence Builder and Sequence Transfer programs enforce the BPWS rules of the fuel designer such that there are no excessive reactivity additions due to sequence step configurations. If the BPWS rules would be violated by the sequence, the Sequence Builder program provides a warning that requires acknowledgement by the licensed operator.

b. The licensed operator will be supplied with a hard copy of the desired sequence and will be required to verify that the loaded sequence in RCMS/RWM agrees with the hard copy after loading any new sequence. This is a Technical Specification (TS) Surveillance Requirement (SR).

   Specifically, SR 3.3.2.1.8 states: "Verify control rod sequences input to the RWM are in conformance with analyzed position sequence." This SR has a frequency of: "Prior to declaring RWM OPERABLE following loading of sequence into the RWM."

3.3.3.2 Man-in-Loop Controls for Activation of Rod Sequence

Placing a given sequence into active use requires the following procedurally-required Man-in-Loop actions.

a. Selection of an active sequence requires that the licensed operator use password entry prior to selection of a sequence.

b. The licensed operator must touch the "MAKE ACTIVE" button on the screen to change the sequence to the new selected sequence.

c. The licensed operator must verify that the name of the newly activated sequence matches the name of the hard copy sequence that was previously verified per SR 3.3.2.1.8 and authorized for use.

3.3.3.3 Man-in-Loop Verification of RWM Operability and Functionality

TSs for the RWM require periodic testing of RWM software-driven Control Rod Blocks. This includes SR 3.3.2.1.2, a Channel Functional Test in Mode 2, SR 3.3.2.1.3, a Channel Functional Test in Mode 1, and SR 3.3.2.1.6, a non-bypass verification. These required functional tests, performed by the either the

licensed operator (i.e., Man-in-Loop), or instrument technicians, validate RWM software functions.

3.3.3.4 Man-in-Loop Controls when RWM is Bypassed

When the RWM function is bypassed, the RCMS software is designed to disallow gang motion, with the exception of gang insertion when the reactor mode switch is in "SHUTDOWN" in order to more rapidly insert control rods in response to an anticipated transient without scram (ATWS) scenario. In addition, if the RWM function is bypassed below the low power setpoint (i.e., less than or equal to 10%) SR 3.3.2.1.9 requires a second licensed operator or other qualified member of the technical staff to verify position of control rods prior to and during the movement of control rods. This SR adds a Man-in-Loop check to the gang withdraw restriction imposed by RCMS software.

3.3.3.5 Man-in-Loop Controls for Selection of a Rod Gang from the Active Sequence

Prior to commencing planned rod moves, including any withdrawals, the licensed operator is required by procedure to perform a required system set-up check of the RCMS. Part of this is a check that the "GANG MODE" RCMS System Level option is in "ENABLE" on the "SYSTEM PARAMETERS" screen only when the active sequence allows gang motion, and no other administrative restriction has been placed on gang use. If the active sequence or other administrative restriction does not allow for any gang motion, procedures require that the licensed operator verify that the "GANG MODE" option is in "DISABLED."

Prior to performing each step of a sequence, the licensed operator is procedurally required to check if "GANG" or "SINGLE" use is allowed/directed for that step of the sequence.

a. If allowed and directed by the active sequence, the licensed operator must select, or verify selected, "GANG" from the Main Control Soft keys. That soft key will change to a green background and the "SINGLE" soft key will return to the gray background color. The licensed operator will then visually verify that the "GANG" soft key is illuminated.

b. If gang motion is not allowed or directed by the active sequence, the licensed operator must select, or verify selected, "SINGLE" from the Main Control Soft keys. That soft key will change to a green background and the "GANG" soft key will return to the gray background color.

c. The licensed operator must select a rod from the current step of the active sequence, or a directly adjacent step, if the rod is at the current step's limit. To do this, the licensed operator will need to access the "SELECT" screen on the "CONTROL MODE" screen.

d. The licensed operator will touch and release the appropriate rod on the "SELECT" screen and then implement the following actions.

   i. When "SINGLE" is directed by the active sequence, the licensed operator must verify only the border on the selected rod turns green on the "SELECT" screen and that the rod that is selected matches the rod specified in the hard copy of the active sequence.

   ii. When "GANG" is directed by the active sequence, the licensed operator must verify the border on the selected rod and all other rods in the gang turn green on the "SELECT" screen and that the gang that is selected matches the gang specified in the hard copy of the active sequence.

3.3.3.6 Man-in-Loop Controls for Movement of a Rod Gang

The licensed operator commences gang withdrawal by pressing the "WITHDRAW" button for single notch movement, and by simultaneously pressing both the "WITHDRAW" and "CONTINUOUS WITHDRAW" buttons for continuous movement. The "WITHDRAW" and "CONTINUOUS WITHDRAW" push buttons are in the same location and in the same configuration as the current RMCS push buttons. These buttons are separated in space by enough distance to ensure that two hands would be required to cause a continuous rod withdrawal.

For each rod in the gang with a withdraw-permissive, when the "WITHDRAW" button is activated by the licensed operator for a single notch movement or both the "WITHDRAW" and "CONTINUOUS WITHDRAW" buttons are simultaneously activated by the licensed operator for continuous movement, the RCMS will generate the appropriate motion commands and send these commands to the RCMS Interface Unit.

For gang motion in a step that ends at an intermediate position, the "POSITION SCREEN" must be displayed. On the "POSITION SCREEN," the rods in the four-rod display will display the gang movement and will indicate "SETTLE" as each rod approaches the end-of-travel or the end-of-step limit.

3.3.4 Assessment of Single Failures

Section 15.4.1.2 of the LSCS UFSAR indicates that the initiating event for the CRWE is operator action and inaction which results in the out-of-sequence selection of the highest worth rod, withdrawal of this out-of-sequence rod fully from the core, and non-acknowledgement of the resulting alarm annunciations, prior to safety system actuation.

From a software perspective, the NUMAC process that was used for development and validation of the RCMS software, as described in Section 3.2.7 above, yields software that has a low probability of failure. However, any software-based system can generate random faults. Based on the development and validation process, there is a very low probability of a common mode failure in those areas that are tested in the V&V testing

process. Because of this low probability of a common mode failure, random errors are assumed in only one program of one component.

3.3.4.1 Active Sequence Upload

The RCMS is designed to only move ganged rods when the RWM sequence has gangs designated, as described in Section 3.3.2.1, "Installing and Activating a Rod Sequence." These sequences are prepared external to the RCMS and are uploaded to the RCMS. If the upload is not correct, either the logic checks of the sequence, or the checksum verification by the transfer program will identify that the sequence was corrupted.

As a backup, the licensed operator will detect an error between the uploaded sequence and the hard copy of the sequence that the licensed operator was provided. Thus, the self-checking software or the Man-in-Loop administrative controls would detect a single failure in the software. A single error by the licensed operator in uploading a sequence will be caught by the logic checks of the RCMS. The diversity of the administrative and design elements ensure that only a correct sequence can be uploaded to the RCMS.

3.3.4.2 Active Sequence Selection/Activation

If a valid sequence is loaded into the RCMS, then it can be activated (i.e., selected for use). This requires a password-protected action by the licensed operator, including procedural verification against a hard copy of the required sequence, and thus cannot be an accidental selection.

Once a loaded sequence is selected as the active sequence, the RCMS will ascertain which step in the sequence is the correct step. The licensed operator is required by procedure to verify that the step is correct and, if necessary, change the sequence alignment to ensure that the correct step is "latched," once again, as directed by procedure. The diversity of the administrative and design elements ensure that only a correct sequence can be selected as active in the RCMS.

Once the active sequence is in place, continuous self-checks inherent to the RCMS are performed to ensure that corruption of the program does not occur during rest periods. Any self-test failure or SR failure will alert the licensed operator of a failure in the system. This continuous check will provide an annunciator alarm if a fault is detected.

3.3.4.3 Selection of a Rod GANG from the Active Sequence

Prior to performing each step of a rod sequence, the licensed operator is procedurally required to check if "GANG" or "SINGLE" use is allowed/directed for that step of the sequence.

If gang motion is administratively allowed, the RCMS Controller must be enabled to allow "GANG" motion. This requires a password-protected action by the licensed operator, including procedural verification against a hard copy of the required sequence, and thus cannot be an accidental selection.

Once the RCMS has been enabled for GANG motion, the licensed operator is then required to select a rod from the latched sequence and verify against a hard copy of the active sequence that the selected rods are from the correct step. If a rod from the current latched step is not selected, the RCMS software will not grant a withdrawal-permissive. This diversity of controls (i.e., software and Man-in-Loop) will ensure that the correct gang is selected for the latched sequence step, even with a single failure.

To ensure that all of the redundancy of the RCMS hardware and software is being applied for a gang withdrawal, the RCMS will prevent gang withdrawal if any RCMS element is bypassed.

3.3.4.4 Movement of a Gang

In order to move a rod gang, the processes described above in Sections 3.3.4.1 through 3.3.4.3 must have been successfully completed without a single failure. These processes ensure that the rod sequence being used in RCMS is the correct sequence, and that the selected gang is correct. The hardware and software also ensure that, for ganged rod withdrawal, no components of RCMS are inoperable or bypassed.

Withdrawal of a gang in Modes 1 and 2 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.

The licensed operator commences gang withdrawal by pressing the "WITHDRAW" button for a single notch movement, or simultaneously pressing both the "WITHDRAW" and "CONTINUOUS WITHDRAW" buttons for continuous movement. The "WITHDRAW" and "CONTINUOUS WITHDRAW" push buttons are in the same location and in the same configuration as the current RMCS push buttons. These buttons are separated in space by enough distance to ensure that two hands would be required to cause a continuous rod withdrawal, thus eliminating the possibility of an inadvertent operator action resulting in a continuous withdrawal of the gang.

Rod motion is implemented by RCMS by controlling a separate HCU output for each rod. There are no common components where a failure could cause multiple rods to move at the same time.

Because the current step in the active sequence is correct, and the correct rod gang has been selected, if the licensed operator initiates a continuous withdrawal, there would be no abnormal condition unless the gang was withdrawn beyond the upper position limit on the latched step.

When each rod in a gang approaches the top of its latched step withdrawal limit, the RCMS will automatically shift the rod to settle to prevent it exceeding its limit. During rod or gang movement, the licensed operator is procedurally required to verify that actual rod travel is in compliance with the applicable step of the active sequence. Thus, the diversity of the administrative and design elements ensure that withdrawal of a gang will stop at its upper withdrawal limit even with a single failure.

In addition, 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 (i.e., rods fully withdrawn), group movement is accepted regardless of 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 (i.e., 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.

3.3.5 Evaluated Single Failures

The possible single failures selected for evaluation are listed below. These possible single failures could occur as a result of a random error during implementation of actions discussed in Sections 3.3.4.1 through 3.3.4.4 above (i.e., in the active sequence upload, active sequence selection/activation, selection of a rod gang from the active sequence, or operator action to move a gang).

- 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 RBM automatic bypass setpoint.

3.3.5.1 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 new RCMS includes controls, displays, and logic to allow the operator to select and drive in or out pre-defined "gangs" of two to four 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.

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.

3.3.5.2 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 since 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.

3.3.5.3 Withdrawal 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 (e.g., 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 average power range monitors 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, 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.

3.3.5.4 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 either of the following occur.

1. The steam flow signal from reactor instrumentation would incorrectly indicate that power was below the automatic bypass setpoint.

   Because both RCMS Interface Units receive steam flow signals from 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 detected by the cross-compare functions of the controllers and the check function of the Interface Units, preventing rod motion.

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.

3.3.5.5 Conclusion

The evaluation described in Sections 3.3.5.1 through 3.3.5.4 indicates that there is no postulated single failure that would cause the uncontrolled withdrawal of ganged rods. Therefore, the postulated accident is an infrequent incident. Moreover, the NRC review and approval in Section 15.4.1 of NUREG-0800 is applicable to the implementation of ganged rod motion at LSCS.

3.4 Description of Potential Consequences if Event Were to Occur

Although the analysis summarized in Section 3.3 indicates that an uncontrolled ganged rod withdrawal error under low-power conditions at LSCS is an infrequent incident, 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, Section 15.4.1, Items 2.a and 2.c.

This evaluation 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 infrequent incident, 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, Section 15.4.1, and is bounded by the spectrum of other analyzed accidents for LSCS.

A brief description of the postulated Continuous Ganged Rod Withdrawal Event is provided below.

Prerequisites:

Up to the point of an error that would cause a gang of rods to start withdrawal, the following assumptions are made:

1. The core is near criticality such that a continuous withdrawal event would cause criticality to occur and the plant to exceed criticality and continue a power increase event until stopped.

2. Below 10% reactor power, the RWM is enforcing the equivalent of a BPWS plan such that flux levels in the core do not generate large hot spots.

3. Between 10% and 30% reactor power, the reactor engineer will not plan a gang of rods that would excessively peak power in the reactor.

4. The gangs used for evaluation are near the pattern used in BWR/6 plants, which currently use ganged rod motion.

5. No additional latent errors exist in reactivity control that could exacerbate the event.

Scenarios:

Case 1 – Power in the Startup Range Near Criticality

Time(Min)	Event
00.00	Gang with largest reactivity starts out
~00.10	IRM Range entered
~00.40	Hi IRM Scram Occurs

Result – No core damage, energy deposited < 170 cal/gm

Case 2 – 10% to 30% Power

Time(Min)	Event
00.00	Gang with largest reactivity starts out
~01.00	Power reaches low power alarm point of the RWM – Gang motion interrupted

Result – MCPR limits not exceeded

4.0 REGULATORY ANALYSIS

4.1 No Significant Hazards Consideration

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," 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. The proposed change revises the current licensing basis for Section 15 of the LSCS Updated Final Safety Analysis Report (UFSAR). Specifically, the proposed change incorporates the description of a new, potential accident into the LSCS 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.

According to 10 CFR 50.92, "Issuance of amendment," paragraph (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.

EGC has evaluated the proposed change, using the criteria in 10 CFR 50.92, and has determined that the proposed change does not involve a significant hazards consideration. The following information is provided to support a finding of no significant hazards consideration.

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   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 allow movement of 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. Both the existing Reactor Manual Control System (RMCS) and the new RCMS are not safety related, are not used for plant shutdown resulting from accident or nonstandard operational conditions, and are not assumed to function during the events analyzed in Chapter 15 of the LSCS Updated Final Safety Analysis Report (UFSAR), including the Control Rod Drop Accident, Control Rod Removal Error During Refueling, Rod Withdrawal Error – at Power, and Continuous Rod Withdrawal during Reactor Startup. The

new RCMS has no interaction with the safety related portion of the reactivity control system.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

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, LLC (EGC) has conducted a technical evaluation of this potential accident and has determined that it is an infrequent incident 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," addresses the evaluation of this event 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," 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 Section 15.4.1 of NUREG-0800 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.

EGC's evaluation indicated that there is no single failure that could cause the uncontrolled withdrawal of ganged rods, and thus the postulated accident is an infrequent incident. Moreover, the NRC review and approval in NUREG-0800,

Section 15.4.1, is applicable to the implementation of ganged rod motion at LSCS.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No

The proposed change involves the implementation of an option in a new RCMS that will allow movement of ganged groups of two to four control rods simultaneously. This is a new function that is not a safety related function. The new function 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, paragraph (c), and accordingly, a finding of no significant hazards consideration is justified.

4.2 Applicable Regulatory Requirements/Criteria

4.2.1 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, GDC 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.

EGC's 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 considered an infrequent incident. Thus the RCMS use of ganged control rod motion meets GDC 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 existing RMCS. 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 GDC 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 an infrequent incident. Thus the RCMS use of ganged control rod motion meets GDC 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 has been evaluated and determined to be an infrequent incident 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 GDC 25.

4.2.2 10 CFR 50.36, "Technical Specifications"

EGC has evaluated the new RCMS, 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 (LCOs) are required in the LSCS TS.

In the current system design at LSCS, control rod patterns during startup conditions are controlled by the operator and the RWM, so that only specified control rod sequences and relative positions are allowed over the operating range of all control rods inserted to 10% rated thermal power. The sequences effectively limit the potential amount of reactivity addition that could occur in the event of a CRDA.

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 new RCMS 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 new RCMS 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 RWM (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 an infrequent incident, and as such, the current Applicability and LCOs for Rod Pattern Control (i.e., TS 3.1.6) and the RWM (i.e., TS 3.3.2.1) bound the new operational configuration.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the

Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

EGC has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, "Standards for Protection Against Radiation." However, the proposed amendment does not involve: (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9). Therefore, pursuant to 10 CFR 51.22, paragraph (b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Letter from J. A. Bauer (Exelon Generation Company, LLC) to U. S. NRC, "Supplemental Information Concerning License Amendment Request to Revise License Basis to Allow Ganged Rod Drive Capability of the Rod Control Management System (RCMS)," dated May 10, 2006

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

3. NUREG-1434, Revision 3.0, "Standard Technical Specifications, General Electric Plants, BWR/6," dated June 2004

4. NUREG-0700, Revision 2, "Human-System Interface Design Review Guidelines," dated May 2002

5. Nuclear Energy Institute 04-04, Revision 1, "Cyber Security Program for Power Reactors," dated November 18, 2005

6. NUREG/CR-6847, "Cyber Security Self-Assessment Method of U. S. Nuclear Power Plants," dated September 2003

7. NRC Regulatory Guide 1.97, Revision 2, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," dated December 1980

ATTACHMENT 3
GE-Hitachi Nuclear Energy Americas LLC Affidavit

GE-Hitachi Nuclear Energy Americas LLC Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, **Tim E. Abney,** state as follows:

(1) I am Project Manager, Services Licensing, Regulatory Affairs GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the following documents:

a. GE Nuclear Energy "Rod Control Management System (RCMS) Software Development Plan" Revision 2, dated March 9, 2007

b. GE Nuclear Energy Specification 23A5162, Revision 3, "NUMAC Software Management Plan," dated March 16, 2006

c. GE Nuclear Energy Specification 23A5163, Revision 3, "NUMAC Software Verification and Validation Plan," dated March 16, 2006

d. GE Nuclear Energy Specification 26A6356, Revision 4, "Rod Control Management System," dated January 18, 2007

e. GE Nuclear Energy Specification 26A6515, Revision 6, "RCMS/MCR Controller Performance Specification," dated May 18, 2007

f. GE Nuclear Energy Specification 26A6517, Revision 3, "Rod Control Management System (RCMS) External Interface Specification," dated March 12, 2007

g. GE Nuclear Energy Specification 26A6518, Revision 4, "RCMS Human System Interface Specification," dated May 24, 2007

h. GE Nuclear Energy Specification 26A6530, Revision 4, "RCMS and MCR Interface Performance Specification," dated May 17, 2007

i. GE Nuclear Energy Specification 26A6582, Revision 2, "Rod Control Management System (RCMS) Internal Communication Protocol Specification," dated April 30, 2007

j. GE Nuclear Energy Specification 26A6609, Revision 3, "Rod Control Management System (RCMS) Displays," dated May 17, 2007

k. GE Nuclear Energy Specification 26A6616, Revision 3, "File Control Processor Performance Specification," dated September 22, 2006

These documents are internal GE design and process documents that are not typically submitted to NRC and as such the content and context of the documents were not created with the intent of being made publicly available. They are only being provided at the explicit request of NRC staff. As such, these documents are deemed to be proprietary in their entirety. Each document is so marked with "GEH PROPRIETARY INFORMATION" on the first page, and a statement at the top of each following page "GEH PROPRIETARY INFORMATION – TRADE SECRET".

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) above is classified as proprietary because it contains processes and techniques as well as results and details of analysis methods developed by GEH for design and development of an improved Rod Control Management System. Development of the processes, methods, techniques, design and related information was achieved at a significant cost to GEH. The development of the Rod Control Management System design constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by GEH.

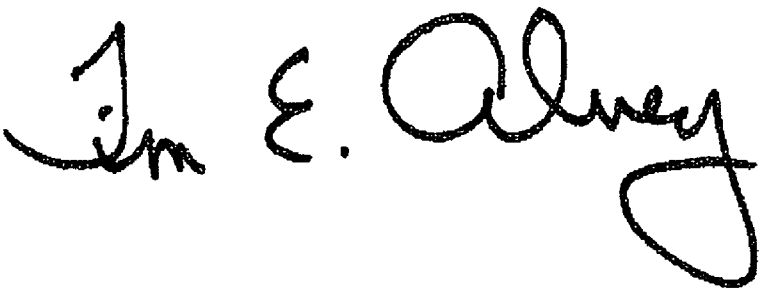
The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical processes, methods, tools and results.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 14th day of August, 2007.



Tim E. Abney
GE-Hitachi Nuclear Energy Americas LLC