ENCLOSURE 1

SAFETY EVALUATION REPORT
EAGLE-21 SYSTEM
WATTS BAR UNIT 1

1.0 BACKGROUND

Improved electronics technology and accumulated operating plant experience have led to the development of a new design to replace the RTD bypass system for reactor coolant system (RCS) temperatures. The benefits attributable to the RTD bypass elimination modification fall into three primary areas: reduced radiation exposure, improved availability, and reduced maintenance. As a result of removing the bypass piping the Tennessee Valley Authority (TVA) states that, radiation exposure to personnel can be reduced on the average t 80 manrems per outage. Availability can be improved by avoiding forced outages attributed to the present RTD bypass system. Maintenance requirements can be reduced by eliminating hardware which require periodic maintenance and inspection.

For the Watts Bar design, the Eagle-21 qualified microprocessor based equipment is being utilized for this RTD bypass elimination. In all, the Eagle-21 process protection system replacement hardware performs the following major functions:

1. Reactor trip protection (channel trip to voting logic)
2. Engineered safeguard features (ESF) actuations.
3. Isolated outputs to control systems, control panels, and plant computers.
4. Isolated outputs to information displays for post-accident monitoring (PAM) indication.
5. Automatic surveillance testing to verify channel performance.

8906190049 890613
PDR ADOCK 05000390
A PDC

The staff performed a comprehensive review of the hardware and software design aspects of the Eagle-21 System. This included a review of the Verification & Validation (V&V) program on the Eagle-21 System to ensure the functionality of the system commensurate with that described in the system requirements. Two staff audits were conducted on the Eagle-21 System design and V&V process. The first audit was held in February 1987, and the primary areas of discussion were the V&V plan and the system design. The second audit was held in April 1989, and the primary areas of discussion were the resolution of issues from the first audit, the verification process, the validation process, and the system design. The results of these audits are presented below.

2.0 EAGLE-21 SYSTEM DESCRIPTION AND DESIGN REVIEW

The mechanical modification removes the valves, piping, snubbers, and supports associated with the RTD bypass system and replaces them with thermowell mounted fast response RTDs which are installed directly into the Reactor Coolant Pipe. Mechanical modifications begin with the removal of the existing bypass piping at each connection point to the Reactor Coolant System. The existing hot and cold leg penetrations are machined to accept RTD thermowells. On the hot leg, the scoop tip will be removed to allow the thermowell to protrude directly into the flow stream. The thermowell is installed inside the modified scoop and the RTD is installed within the thermowell. The crossover leg connection is capped and an additional cold leg boss, thermowell and RTD are added as an installed spare.

The Eagle-21 family of qualified microprocessor based equipment is utilized to electronically average three hot leg RTD's to obtain a single hot leg average temperature (TH_{AVG}). The system used to calculate this average temperature is referred to as the temperature averaging system (TAS). The temperature averaging system (TAS) becomes part of the thermal overpower and overtemperature protection system (Delta T / T_{AVG} Protection) because TAS output (TH_{AVG}) replaces the hot leg temperature signal previously measured in the bypass manifold RTD. The TH_{AVG} signal is used in the calculation of the delta temperature (Delta T) and average temperature (T_{AVG}). The modular design of the Eagle-21 electronics allows for installation of the digital hardware into existing process racks. One rack per protection channel set is configured primarily for Delta T / T_{AVG} protection. However, other analog signals such as neutron flux from upper and lower ion chambers, and pressurizer pressure are routed to the Eagle-21 loop processor. All analog hardware with the exception of the field termination blocks will be removed from these racks and be replaced with Eagle-21 digital electronics.

2.1 Redundancy and Isolation

The Eagle-21 Process Protection System is designed to provide redundant instrumentation channels and outputs to two trip logic trains for each protective function. These redundant channels and trains are electrically isolated and physically separated. Thus any single failure within a channel or train will not prevent a required protection system action. The Eagle-21 Process Protection System is independent from the control system. The transmission of signals from the Eagle-21 to the control system is through qualified isolation devices. The results of the fault testing of the isolation devices was provided in WCAP-11733 "Noise, Fault, Surge, and Radio Frequancy Interference Test Report" (dated June 1988) with clarifying information provided by a letter dated May 22, 1989. The Eagle-21 System uses the output signal conditioning boards as an isolation barrier between field level signals and the microprocessor subsystem. The Eagle-21 uses the following types of isolation devices for interfacing Class 1E signals with Non-Class 1E equipment:

Isolator Board Type	Isolation Device
Analog Output Board (current loop)	Transformer
Digital contact Output Board	Relay
Partial Trip Output Board	Optical Isolator

In addition, high voltage transient protection is provided for each cabinet input/output, including the ac power feed, by transient suppression circuitry.

The purpose of the fault tests was to demonstrate that credible faults injected into the Non-Class 1E system do not propagate across the Non-Class 1E to Class 1E isolation barrier or from channel to channel within the Eagle-21 process rack. These tests were designed to verify that the Eagle-21 system isolation devices are in compliance with IEEE-279-1971, IEEE-384-1981, and Regulatory Guide 1.75, Rev. 2 concerning the physical independence of Class 1E circuits and Class 1E/Non-Class 1E interaction.

Maximum credible fault voltages were determined to be 580 Vac and 250 Vdc per previous protection system tests (7300 system, Qualified Display Processing System). In addition, 125 Vac and 125 Vdc tests were performed where applicable. A fault was considered applicable only if the fault challenged the nominal voltage or current ratings of the channel under test. For cases where 125 Vac and 125 Vdc tests were considered not applicable, 580 Vac and 250 Vdc tests were performed thus enveloping the lower voltage tests.

The Surge Withstand Capability (SWC) tests were conducted under normal operating conditions of the system in accordance with IEEE-472-1974. The purpose of this test was to show: (1) the protective actions of the Eagle-21 System are not affected by application of the surge withstand test wave to the designated Non-Class 1E to Class 1E isolators, (2) that no component failures occurred, and (3) that no change in channel calibrations occurred due to the application of the surge withstand test wave. All system inputs/outputs were surge tested in the common and transverse modes including the system power supply input circuitry.

All of the isolators passed the pass/fail criteria for all of the tests noted above. Therefore, the requirement that the isolators protect the Class 1E side of the isolator is satisfied and the requirements of General Design Criterion

(GDC) 25 and IEEE-STD-279-1971 regarding isolation are met. The staff concludes that the isolation devices are acceptable.

2.2 Bypass and Testing

The Eagle-21 Process Protection System performs automatic surveillance testing at the digital process protection racks via a portable Man Machine Interface (MMI) test cart. The MMI test cart is connected to the process rack by inserting a connector into the process rack test panel. Using the MMI, the "Surveillance Test" option is then selected. Following instructions entered through the MMI, the rack test processor automatically performs calibrations, Analog to Digital convertor tests, response time tests and dynamic algorithms and bistable setpoint accuracy tests.

Interruption of the bistable output to the logic circuitry for any reason (test, maintenance purposes, or removal from service) causes that portion of the logic to be actuated and accompanied by a channel trip alarm and channel status light in the control room. Each channel is fully testable via the portable MMI test cart.

Status lights on the process rack test panel indicate when the associated bistables have tripped. The value (in engineering units) that caused the bistable to trip is displayed on the MMI screen.

The Eagle-21 Process Protection System provides for continuous on-line self-calibration of analog input signals. The Digital Filter Processor (DFP) provides high and low reference signals to a multiplexer circuit on each analog input channel. The DFP then compares the output of its Analog to Digital (A/D) Converters to the high and low reference signals to determine if any errors have been introduced by analog signal processing and A/D conversion. If necessary, the DFP automatically adjusts the D/A gain and offset to eliminate any errors that have been introduced.

The Eagle-21 Process protection equipment is designed to permit any one channel to be maintained, and when required, tested during power operation without initiating a protective action at the system level. During such operation, the process protection system continues to satisfy single failure criterion.

If an Eagle-21 protection channel has been bypassed for any purpose, a signal is provided to allow this condition to be continuously indicated in the control room.

The Eagle-21 design has provided for administrative controls and multiple levels of security for bypassing a protection channel. To place a protection channel in bypass, an individual must have access to the following:

A. Man-Machine Interface test cart.

B. Keyboard for the MMI test cart.

C. Key for the process rack door. A status light on the control board alerts the operator that the protection set has been entered. If a technician opens the doors of two protection sets, the operator is alerted by an annunciator.

D. Key for the rack mounted test panel selector switch.

E. Password that is entered through the MMI keyboard.

The Eagle-21 design has provided for administrative controls and multiple levels of security for access to setpoint and tuning constant adjustments. In order to adjust a setpoint or tuning constant in the Eagle-21 system, an individual must have access to A through E as stated above and, in addition, must have knowledge of the allowable range for the specific parameter to be updated.

2.3 Diagnostics

The Eagle-21 Process Protection equipment provides specific diagnostic information to the user via numerous printed circuit cards and test panel status LEDs, as well as information available through the portable Man-Machine-Interface (MMI). This design feature allows for easy recognition, location, replacement, and repair or adjustment of malfunctioning components or modules.

2.4 Equipment Qualification

The Equipment Qualification Program demonstrated that the Eagle-21 equipment is capable of performing its designated safety-related function under the required environmental and seismic conditions. This was accomplished by testing as follows:

(1) Environmental testing (IEEE-STD-323-1974)

(2) Seismic testing (IEEE-STD-344-1975)

The tests and results were documented in WCAP-8687, "Eagle-21 Process Protection System (Environmental and Seismic Testing)," dated May 1988.

Noise, Fault, Surge Withstand Capability, and Radio Frequency Interference (RFI) tests demonstrated that the Eagle-21 equipment is capable of performing its designated safety related function when subjected to specified test conditions. The tests and results were documented in WCAP-11733, "Noise, Fault, Surge, and Radio Frequency Test Report for Eagle-21 Process Protection Upgrade System," dated June 1988.

The Eagle-21 equipment was subjected to the following noise sources:

- o Random Noise Test (Antenna Coupled)
- o Crosstalk Noise - Chattering Relay Test (Antenna and Direct Coupled)
- o Military Specification MIL-N-19900B Noise Test (Antenna Coupled)
- o High Voltage Transient Noise Test (Antenna Coupled)
- o Static Noise Test (Antenna and Direct Coupled)

For the random, high-voltage transient, and military specification noise tests, the noise source was antenna coupled to the Non-Class 1E field wiring under test. The noise source was applied to a 40-foot antenna wire adjacent to a 40-foot length of unshielded Non-Class 1E field wiring. The antenna was brought directly into the cabinet and bundled with Class 1E input/output cables upon entering the process rack.

The Non-Class 1E test cable was terminated with a nominal load value. The crosstalk and static noise tests were conducted similarly, except that an additional test was performed where the noise source was applied directly to the Non-Class 1E wiring. To prevent damage, the isolator was disconnected at the Eagle-21 termination frame and the disconnected Non-Class 1E wires shorted to complete the cross talk noise circuit loop. The disconnected Non-Class 1E wires were open-circuited for the static noise test.

The purpose of the Radio Frequency Interference (RFI) susceptibility test was to evaluate the performance of the system when subjected to electromagnetic fields such as those generated from portable radio transceivers or any other devices that generate continuous-wave radiated electromagnetic energy. The Eagle-21 System remained operational while exposed to RFI. Analog input/output processing and protective action functions were affected but demonstrated full recovery upon removal of the RFI. To avoid system perturbations, the vendor has recommended that the Eagle-21 System equipment rooms be zoned to prohibit the use of transceivers in the 20-700 MHz band. TVA has stated that to alleviate this concern, the use of transceivers would be prohibited during plant operation in these equipment rooms. The staff concludes that the RFI test results concurrent with the ban of transceivers in the 20-700 MHz band is acceptable.

2.5 Reliability

An availablity assessment of the Eagle-21 equipment versus the equivalent analog process protection systems was performed by the vendor. The results of this assessment were provided to the staff during the second audit and illustrated that the Eagle-21 digital system availability was equal to or higher than the equivalent analog system availability. Therefore, it was concluded that the reliability of the Eagle-21 system is at least as reliable as and perhaps even more reliable than the analog system. Furthermore, it was believed that by incorporating the fail-safe design principal, redundancy, functional diversification and test features of the Eagle-21 system, its availability results would show further improvement. The staff concluded that the issue regarding the Eagle-21 reliability was resolved. This conclusion was based on our analysis of the vendor's Eagle-21 reliability study.

3.0 Eagle-21 Software Description and Review

The Eagle-21 hardware has been designed in a modular fashion. The basic subsystems are:

1. Loop processor controller

   The Loop process controller receives a subset of the process signals, performs one or more of the protection algorithms, and drives the appropriate channel trip (or partial engineered safeguards actuation) signals. It also drives the required isolated outputs.

2. Tester subsystem

   The tester subsystem serves as the focal point of the human interaction with the channel set. It provides a user-friendly interface that permits test personnel to configure (adjust setpoints and tuning constants), test, and maintain the system.

3. Input/Output (I/O)

The microprocessor based system interfaces with the field signals through various input/output (I/O) modules. The modules accommodate the plant signals and test inputs from the Tester Subsystem, which periodically monitors the integrity of the Loop Processor Subsystem.

The separation of these three elements into separate buses and microprocessors reduces the probability of interaction between them.

The purpose of the first audit (February 3-4, 1987) was to review the Eagle-21 design process and perform an evaluation of the V&V plan. By letter dated March 24, 1989 from R. Gridley to U.S. Nuclear Regulatory Commission pertinent information was provided to the staff. Included was a revised Design, Verification and Validation Plan (Rev. 2) dated February 25, 1989. A second audit regarding the utilization of the Eagle-21 hardware, the resolution of the concerns that remained from the first audit, and the results of the verification and validation process was performed by the staff on April 24, 25, and 26, 1989.

Building upon the experience gained in performing software verification and validation (V&V) on the IPS prototype and implementing the process, a much improved program was defined for the South Texas Qualified Display Processing System (QDPS). The V&V process to be implemented for Watts Bar RTD bypass elimination modification is the same as the one conducted on the South Texas QDPS, modified only to the extent of refining the process to resolve South Texas staff comments. It should also be noted that a portion of the software modules required for the Watts Bar project have already been verified as part of the South Texas V&V program.

3.1 Verification and Validation Plan

During our first audit, we evaluated the V&V plan. We compared the V&V plan to ANSI/IEEE-ANS-7.4.3.2.-1982, "Application Criteria for Programmable Digital Computer System of Nuclear Power Generating Stations". We noted in Reference 1 that the independent design verification of initial design activities and products was not clearly present in the V&V plan. The manufacturer (Westinghouse) had proposed using members of the design organization in the verification phase. However, the individual who participated in the design of a module of code would not participate in its subsequent verification. Furthermore, the plan proposed that the designers and verifiers will be able to report to the same supervisor.

This concern was resolved during the second audit when it became apparent that organizational independence (e.g., different first line supervisor) was provided for the verification and validation process. This clarification resolved this first audit concern for Watts Bar. However, the vendor has not formally incorporated organizational independence in the V&V plan so this remains an open item regarding its future use.

The staff reviewed the verification techniques associated with the Class 1E and Non-Class 1E software and found the techniques acceptable. However, the staff, as a result of the first audit, believed that all software associated with th Eagle-21 mainframe should be classified as Class 1E software and receive the highest verification level available unless the applicant can provide acceptable justification for classifying this software as Non-Class 1E. The basis for this conclusion is that it has not been shown that this particular software meets the three criteria outlined by the applicant for the determination of the safety category for the software. During the second audit, the applicant provided documentation that showed all Eagle-21 software being treated as Class 1E. As a result, the staff concluded that this first audit concern is resolved.

During our first audit, we identified a concern regarding the criteria for determining a "simple" or a "complex" unit (Section 5.4.4.2 of the Verification and Validation Plan). Revision 2 of the Eagle-21 Design Verification and Validation Plan contains revised criteria for determining whether a software unit is "simple" or "complex". The staff reviewed this revised criteria (V&V Plan, Rev. 2) and concluded that it was acceptable. The purpose of this classification is to determine the need for unit testing. All units classified as complex undergo a formal unit test program, whereas, simple units have their code reviewed and are not tested as a unit.

During the second audit, seven units of code were identified as simple units within the protection part of the system. The staff inspected each of these units and accepted their classification as a simple unit. As a result, these seven units were not subjected to a formal unit test. However six of these units were exercised during the validation testing and the resulting evidence indicated that these units performed their function properly. The code for the seventh unit was not exercised during the validation tests because it would have required a destructive test. Upon our inspection, it was determined that the unit was very short (less than six lines of code) and the logic was straight forward. Based on this inspection it was determined that the code would perform its intended function. TVA agreed to document the data and the basis for the acceptability of this unit of code. The staff concluded that this was acceptable and that the "simple" and "complex" concern was resolved.

3.2 <u>Verification Process and Results</u>

The verification process may be divided into two distinct phases: (1) Review of design documentation, and (2) Testing of software. The reviews consisted of design documentation review, source code review, and a functional test review. The design documentation review involves the comparison of a design document for a unit of software to the design requirement to verify performance requirements. The source code review interprets operation of the code and compares it with the expectation. In a functional test review, the verifier reviews the documentation associated with the functional tests performed by the designer of the code. Tests of the software within the verification process consisted of structural testing and functional testing. Structural testing attempts to comprehensively revise the code and its logic within a unit. The test input is chosen to exercise all the possible control paths within the unit. In functional testing, test cases are constructed from the functional properties of the program, which are documented in the design specification. Functional tests were required to evaluate modules and subsystems of code.

During the second audit, the staff verified that formal trouble reports were utilized to document all anomalies found during the verification process. The trouble reports were forwarded to the software design organization for resolution. The software is then recaptured within the verification process for the independent verification of its correct resolution.

In addition to trouble reports, clarification reports were issued when the verifier found something of a minor nature which was not significant enough to fail a unit. These were typically typographical or other minor documentation errors. The clarification reports also provided a mechanism for identifying to the designer something minor which occurred during testing. All clarification reports were satisfactorily resolved.

The verification trouble reports were assigned error codes as each report was generated. Working from a list of possible error codes used to classify previous software efforts, a significant portion (67%) of the total was made up of five error types. These were expected to be the dominant error types.

Our audit review of the documentation associated with this process confirmed that the verification plan was followed and the results were satisfactory.

3.3 Validation Process and Results

The validation process is performed to demonstrate the system functionality. This process consists of functional requirements testing, abnormal-mode testing, system prudency review/testing, and specific man-machine interface testing.

The functional requirements tests illustrate conformance to the top level functional requirements and sub-requirements as identified in a requirements matrix. Each sub-requirement has a test or series of tests to illustrate conformance.

The requirements for abnormal mode testing are established by a review of functional requirements to identify abnormal-mode conditions. Each abnormal-mode condition is identified, test criteria established, and then tested for performance.

A system prudency review was conducted when the software units and modules were integrated into a system. The prudency review resulted in system level requirements that were not obvious at the start of the design process. These requirements were integrated into a checklist called the System Prudency Checklist. The System Prudency Checklist addresses the following technical issues:

1. firmware program storage,
2. data-base information storage,
3. multiple-processor shared memory storage
4. data-link oriented system architectures, etc.

Most of these items do not relate directly to a functional requirement, but address the issue of integrated system integrity. Test cases were developed and run in response to the checklist to confirm system integrity.

The specific man-machine interface testing ensures that the operation interface used to modify the system's data-base performs properly under normal-mode and abnormal-mode data entry sequences. This is a critical area requiring special attention due to the impact on the software of the system-level information which can be modified through this interface.

A formal trouble report documented each anomaly found during validation is issued and is forwarded to the software design organization for resolution. The software is then recaptured in the verification and validation process. In our audit review of these trouble reports, we found that the reports dealt only with system level problems which was to be expected. As such, these problems would not normally have been detected during the verification process.

This conclusion reflects favorably on the verification process in that no errors were discovered that should have been detected in the verification process. In addition, the modifications to the as-coded and verified system resulting from validation testing were small in number and random in nature.

The validation and design teams identified five methods for resolving the problem reports; software changes; hardware changes; functional requirement changes; validation test procedure changes; and no problem identified. Seventy four (74) percent of the validation problem report and resolution were either test procedure changes or no problem identified.

As a further assurance that the verification and validation process was adequate, the staff conducted a walkthrough of a "thread" of information that was being used by the Eagle-21 System. The wide range pressure signal was selected for the walkthrough. The walkthrough began at the transmitter input (1PR-406) to the analog input board (1PR-406 025-08 Channel 3). The analog input board contained the power source, the surge and filter network, the test relay (IPS/406), a multiplexer, an operational amplifier used as a buffer and one used as a transformer coupled isolation device. The signal exited this board via plug J1 (pins 14 and 15) at which time it entered the loop processor subsystem at plug J3 (pins 12 and 14). There are four modules within the loop processor subsystem. The first module (DFP#1) houses the multiplexer, and the analog to digital convertor with a fixed filter and a shared memory. The second module (LCP) is the loop control processor which houses the process protection program. The third module (DAC#2) is a digital to analog convertor with a multiplexer and sample and hold output driver. The fourth module (DDC) has a parallel input/output interface along with an output driver. The third and fourth modules output the signal to an analog output card (EAO-02) and a partial trip output (EPT-01) respectively. These cards contain buffers, isolation devices, a deadman timer (trip output) which is usually set at 125ms and surge networks. At this point the signal returns to the normal path of the 7100 process system. During the walkthrough, a unit of software was selected at random and audited in detail. The V&V procedures for the unit of software were found acceptable and in conformance with the design specification. The unit of software selected was the DFP-ERROR unit which is used to set quality. Other units of software pertinent to the wide range pressure channel were reviewed but not to the level of detail as the first unit selected.

Based on the results of our first audit (Reference 1) and the results of this audit, the staff concludes that the Eagle-21 functional upgrade as implemented for Watts Bar is demonstrated to meet its functional and design requirements. Furthermore, the staff concludes that the Design, Verification and Validation Plan and resulting processes are acceptable.

3.5 Software Maintenance

The applicant has committed to utilize the Eagle-21 vendor and the existing V&V program as approved by the staff for all software maintenance/modifications. There appears to be strict control within the present V&V configuration management system and adequate procedures for issuing new system revisions are present. The applicant's present software maintenance program is acceptable. However, if in the future, the applicant proposes any changes in the software maintenance practice area, the staff will review these proposed changes based on current software regulatory guidance.

In addition, a procedure has been implemented by the applicant and the vendor which produces computer-generated labels, one for the top and one for the bottom of each PROM. This label generation occurs at the same time the code is generated that is burned onto the PROM. The purpose here is to provide a unique and unremovable identification so that the PROMs will not be inadvertently placed on the wrong boards or in the wrong place on the correct board. The applicant is required to maintain the dual PROM labeling practice for any PROM replacements. The staff concludes that the PROM identification method is acceptable.

4. CONCLUSIONS

Based on our review of information provided by the licensee, the results of the first audit (Reference 1) and the results of the second audit, the staff finds that there is reasonable assurance that the Eagle-21 system conforms to the applicable regulations and guidelines. The scope of the review included the FSAR descriptive information; electrical, instrument, and control drawings; and several Westinghouse Topical Reports. In addition, the staff met twice with the applicant and the NSSS vendor. These meetings provided a focus for exchanging information and answering staff questions. Based on the review noted above and the exchange of information at the two meetings, the staff has reached the following conclusions.

The Eagle-21 System adequately conforms to the guidance for periodic testing in RG 1.22, "Periodic Testing of Protection System Actuation Functions," and IEEE 338, as supplemented by RG 1.118, "Periodic Testing of Electric Power and Protection Systems." The bypassed and inoperable status indication adequately conforms to RG 1.47, "Bypassed and inoperable Status Indication for Nuclear Power Plant Safety Systems." The Eagle-21 System adequately conforms to the guidance on the application of the single-failure criterion in IEEE 379, as supplemented by RG 1.53, "Application of the Single-Failure Criterion to Nuclear Power Plant Systems." On the basis of its review, the staff concludes that the Eagle-21 System satisfies IEEE 279 with regard to system reliability and testability. Therefore, the staff finds that GDC 21 is satisfied.

The Eagle-21 System adequately conforms to the guidance in IEEE 384 as supplemented by RG 1.75, "Physical Independence of Electric Systems," for protection system independence. On the basis of its review, the staff concludes that this system satisfies IEEE 279 with regard to independence of systems and hence satisfies GDC 22.

On the basis of its review of the interface between the Eagle-21 System and plant-operating control systems, the staff concludes that the system satisfies IEEE-279 with regard to control and protection system interaction. Therefore, the staff finds that GDC 24 is satisfied. On the basis of its review of the software design and its verification and validation, the staff concludes that the Eagle-21 System satisfies the requirements of ANSI/IEEE-ANS-7.4.3.2-1982 "Application Criteria for Programmable Digital Computer Systems in Safety Systems of Nuclear Power Generating Stations" and Regulatory Guide 1.152, "Criteria for Programmable Digital Computer System Software in Safety-Related Systems of Nuclear Power Plants".

The staff's conclusions noted above are based on the requirements of IEEE 279 with respect to the design of the safety-related portion of the Eagle-21 System. Therefore, we find that 10 CFR 50.55 a (h) is satisfied. In summary, we conclude that the Eagle-21 System meets all of the applicable guidelines and regulations and that its utilization as discussed previously is acceptable. However, this acceptance is conditional on the staff's post installation inspection that verifies that the Eagle-21 system has been implemented as discussed in this SER and satisfactory completion of a pre-operational test prior to plant start-up.

5.0 REFERENCE

Memorandum from Charles E. Rossi to Tom Kenyon, "First Audit Report on RTD Bypass Loop Elimination Mitigation of Eagle-21 Electronics Watts Bar," dated March 23, 1983