UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

July 16, 1992

Docket Nos. 50-259, 50-260,
and 50-296

LICENSEE: Tennessee Valley Authority

FACILITY: Browns Ferry Nuclear Plant, Units 1, 2, and 3

SUBJECT: SUMMARY OF A MEETING WITH THE LICENSEE REGARDING A PROGRAM INITIATIVE TO UPGRADE CURRENT ANALOG CONTROL SYSTEMS WITH DIGITAL CONTROL SYSTEMS

On May 28, 1992, representatives of the NRC and the Tennessee Valley Authority (TVA) met at NRC headquarters in Rockville, Maryland, to discuss TVA's plans for upgrading existing Instrumentation and Control systems at the Browns Ferry Nuclear Plant (BFN) from analog to digital. TVA is currently working with the Electric Power Research Institute (EPRI) as part of an industry initiative to develop an integrated approach in the application of digital monitoring and control systems. Meeting attendees are listed in Enclosure 1. A copy of TVA's agenda is provided as Enclosure 2.

The principal purpose of this meeting was to present the staff with a general overview of TVA's proposed process for analog-to-digital replacement, and to elicit staff comments. During the meeting, the staff fielded numerous questions regarding analog-to-digital replacement under the provisions of 10 CFR 50.59 and on a variety of other digital related issues, such as software verification and validation (V & V), the independence of the V & V group, and electro-magnetic interference qualification. Although TVA's presentation did not go into specific details, it did outline TVA's approach on software V & V which included a graded classification scheme that would dictate the rigor and depth of V & V. The staff expressed its concerns on how safety-related systems would be treated under such a scheme and whether system level validation

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alone could be substituted for V & V in certain cases. At the end of the meeting, TVA stated it would be submitting a license amendment to support a plant modification to install digital refueling floor radiation monitors. TVA also indicated it would be evaluating the staff's comments with regard to future analog-to-digital replacement projects.

Thierry M. Ross, Senior Project Manager
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Enclosures:
1. Attendees
2. TVA Agenda

cc w/enclosures:
See next Page

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Enclosure 1

ATTENDEES

BROWNS FERRY ANALOG-TO-DIGITAL MEETING

MAY 28, 1992

Name	Organization
Scott Newberry	NRR/SICB
Jerry Mauck	NRR/SICB
Cliff Doutt	NRR/SICB
Garry Garten	NRR/SICB
Thierry Ross	NRR/PDII-4
Dave LaBarge	NRR/PDII-4
Joe Williams	NRR/PDII-4
Christina Antonescu	NRR/EMEB
Joe McCarthy	TVA/BFN Restart
Greg Pierce	TVA/BFN Licensing
Mike Hellums	TVA/Corporate Licensing
D. T. Langley	TVA/BFN Engineering
Ron Reeves	TVA/Corporate Engineering
Henry Jones	TVA/BFN Engineering

ENCLOSURE 2

TVA/NRC Meeting on Digital Control and Monitoring Systems

I. Purpose

To demonstrate sufficient control measures for the design of digital control and monitoring systems for use at TVA's Browns Ferry Nuclear Plant.

A) Browns Ferry Nuclear Plant is working with the Electrical Power Research Institute (EPRI) as part of the Instrument and Control upgrade initiative.

1) To apply today's technology in control systems of existing nuclear plants.

2) To develop an integrated approach in the use of microprocessor based control systems

3) To provide industry expertise and experience to aid Browns Ferry in the application of digital control and monitoring systems.

II. Digital Control and Monitoring Systems Application Objectives for Browns Ferry Nuclear Plant

A) Increase the efficiency of the control systems by interconnection of various "islands of control" to optimize their operation. However, upon loss of this interconnection, these "islands of control" can still operate the system.

B) Increase control system reliability by minimizing system down-time as a result of a equipment failure or human error with the use of fault tolerant designs.

C) Increase control system reliability and reduce system down-time with the use of system self diagnostics for early warning of equipment malfunction. This self diagnostics capability will reduce down-time and trouble-shooting of a system by providing early notification and explanation of malfunction.

D) Each major control system upgrade will interface with the plant computer for improved operator information and process system data availability.

III. Qualification of control systems

A) System Definitions

1) Safety-Related Protection Set Systems

Sense and command features of systems involved in generating signals for the reactor trip and engineering safety features.

2) Safety-Related Systems

Systems which perform any of the following:

a) The capability to shutdown the reactor and maintain it in a safe condition

b) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the 10 CFR 100 guidelines.

c) Maintain the integrity of the reactor coolant pressure boundary

3) Quality-Related Systems

Systems that do not meet the definition of safety-related, but provide reasonable assurance that the facility can be operated without undue risk to the health and safety to the public.

4) Important to Operations Systems

Systems that are not Safety-Related or Quality Related, but are necessary for plant operation.

B) Graded qualification requirements

1) Safety Related Protection Set

Software qualification requirements for these systems have been developed to ensure compliance with TVA's committment to Regulatory Guide 1.152, "Application Criteria for Programmable Digital Computer System Software of Nuclear Power Plants", which endorses ANS/IEEE 7-4.3.2-1982, "Application Criteria for Programmable Digital Systems in Nuclear Power Generating Stations".

Qualification Program Documentation:

a) Software Quality Assurance Plan (SQAP)

A SQAP will be established to define the formal software development process to be used. The minimum requirements for the SQAP are defined in the TVA procedures.

b) Software Requirements Specification (SRS)

The SRS delineates the essential capability(ies) the software is required to possess. The minimum requirements for the SRS are defined in the TVA procedures.

c) Software Design Description/ Specification (SDD/S)

The SDD/S provides a technical description of how the software will meet the requirements set forth in the SRS. The minimum requirements for the SDD/S are defined in the TVA procedures.

d) Software Verification and Validation Plan (SVVP)

The SVVP documents all of the activities neccessary to ensure that the software adequately performs all intended functions and that it does not perform any unintended functions. The SVVP will specify the hardware and software configuration, the criteria for test case selection, error handling procedures, and acceptance criteria. The SVVP shall be developed, and executed by qualified individuals other than those who developed the software.

d) SVVP (continued)

1) Software Verification
Software Verification will consist of the following:

a) A system requirements review to determine if the requirements are correct, complete, consistent, and testable.

b) A sign review, module testing or a code walk through to demonstrate that the stated systems requirements are satisfied in the system software design.

c) An examination of the source code listing to ensure adherence to the coding standard and conventions and that the code implements the system design.

d) Verification that the system users manual reflects the proper use of the software.

2) Software Validation

For software validation, testing is to be the primary method for validation. An integrated test of the final hardware and software design at the end of the development phase. The test will demonstrate that the required functions can be achieved under normal and credible abnormal conditions.

e) Software Verification and Validation Report (SVVR)
The SVVR documents the results of the verification and validation activities. This report will document the test equipment used, software tools and test cases used, errors detected and resolved, and a summary of results showing that the acceptance criteria have been satisfied.

2) Safety Related Systems

For Safety Related systems, the software requirements are equivalent to the Safety Related Protection Set systems with the exception that some flexibility is allowed in defining the degree of independent verification that must be applied. A comprehensive, indepe dently reviewed validation test is required if independent verification is not applied to the software development steps. When this process is used, the process must be justified and documented in a retrievable manner.

3) Quality-Related Systems

For Quality-Related systems, the software requirements are equivalent to the Safety-Related systems, unless the quality requirements for the system are defined by TVA augmented quality assurance program which may allow a graded or less stringent requirements.

4) Important To Operations Systems

For Important To Operations systems, formal plans and procedures for the SQAP, SVVP, error handling and reporting are not required as long as the supplier has established practices/policies to ensure the intent of these requirements are met.

C) Software Developed Under 10CFR50 Appendix B

When the software has been developed under a 10CFR50 App. B program an evaluation will be performed to determine acceptability, development process, and documentation. The objective of this evaluation is to determine that sufficient evidence is available to ensure the software will perform its intended function.

D) Commercial Grade Dedication of Software

The objective of commercial grade dedication is to establish reasonable assurance that the software will perform required functions. EPRI report NP-5652, although not specifically for computer applications provides general guidance for the commercial dedication process.

IV. Configuration Management of Software

A) Qualification documentation of software are considered design input and will be continually maintained.

B) Design output documents for software
Design output denoting software title and revision with the processor's hardware (configurable components) the equipment is qualified for use in the control system.

C) The design change process will be utilized for software changes to control systems

D) Software changes will be "V&Ved" for confirmation of new operation and no adverse affects for existing software

V. Electromagnetic Interference (EMI) / Radio Frequency Interference (RFI) testing

A) Conducted EMI transient susceptibility testing

B) Conducted RF EMI susceptibility testing

C) Line coupled transient EMI susceptibility testing

D) Line coupled RF EMI susceptibility testing

E) Conducted emmissions

F) Surge withstand capability testing

G) Radiated RF EMI field susceptibility testing

CONCLUSION

TVA believes that the use of the program and methodology described in the above discussion will ensure adequate computer system design.

DISTRIBUTION

Docket or Central File	
NRC & Local PDRs	
BFN Rdg. File	
T. Murley/F. Miraglia	12-G-18
J. Partlow	12-G-18
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G. Lainas	14-H-3
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