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DATE OF MEETING

09/05/2002

The attached document(s), which was/were handed out in this meeting, is/are to be placed in the public domain as soon as possible. The minutes of the meeting will be issued in the near future. Following are administrative details regarding this meeting:

Docket Number(s)	<u>50-424 AND 50-425</u>
Plant/Facility Name	<u>VOGTLE, UNITS 1 AND 2</u>
TAC Number(s) (if available)	<u>NA</u>
Reference Meeting Notice	<u>AUGUST 19, 2002</u>
Purpose of Meeting (copy from meeting notice)	<u>DISCUSS UPGRADE OF EXISTING SEQUENCERS</u>
	<u> </u>
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NAME OF PERSON WHO ISSUED MEETING NOTICE

F. RINALDI

TITLE

PROJECT MANAGER

OFFICE

NRR

DIVISION

DLPM


BRANCH

PD II-1

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DF01



Overview of Vogtle Electric Generating Plant (VEGP) Safety Features Sequencer (SFS) Upgrade

September 5, 2002

Introduction of Team Members

Southern Nuclear

- Lewis Ward
- Ron Bush
- Jack Stringfellow
- Steve Swanson

Westinghouse

- Glenn Lang
- Carl Vitalbo
- Denny Popp
- Jim Andrachek

Meeting Agenda

- Introductory Remarks
- Design Modification Implementation Schedule
- Scope of Design Modification
- Licensing Evaluation
- Summary
- Questions and Answers

Purpose of Meeting

- Inform NRC of VEGP SFS digital upgrade project
 - Scope, schedule and status of upgrade
 - Licensing approach
 - *10 CFR 50.59
 - * Diversity & Defense-in-Depth analysis
 - * Deterministic/probabilistic approach used for addressing FSAR Chapter 15 initiating events

Design Modification Implementation Schedule

- Unit 1, Train B - Fall refueling outage, September 2003
- Unit 2, Train A - Spring refueling outage, April 2004
- Unit 1, Train A - Spring refueling outage, March 2005
- Unit 2, Train B - Fall refueling outage, October 2005

Scope of Design Modification Description of Existing VEGP SFS

- 2- Train System
 - Single Channel in Each Train
- Two SFSs per Unit (one per train)

Scope of Design Modification Description of Existing VEGP SFS

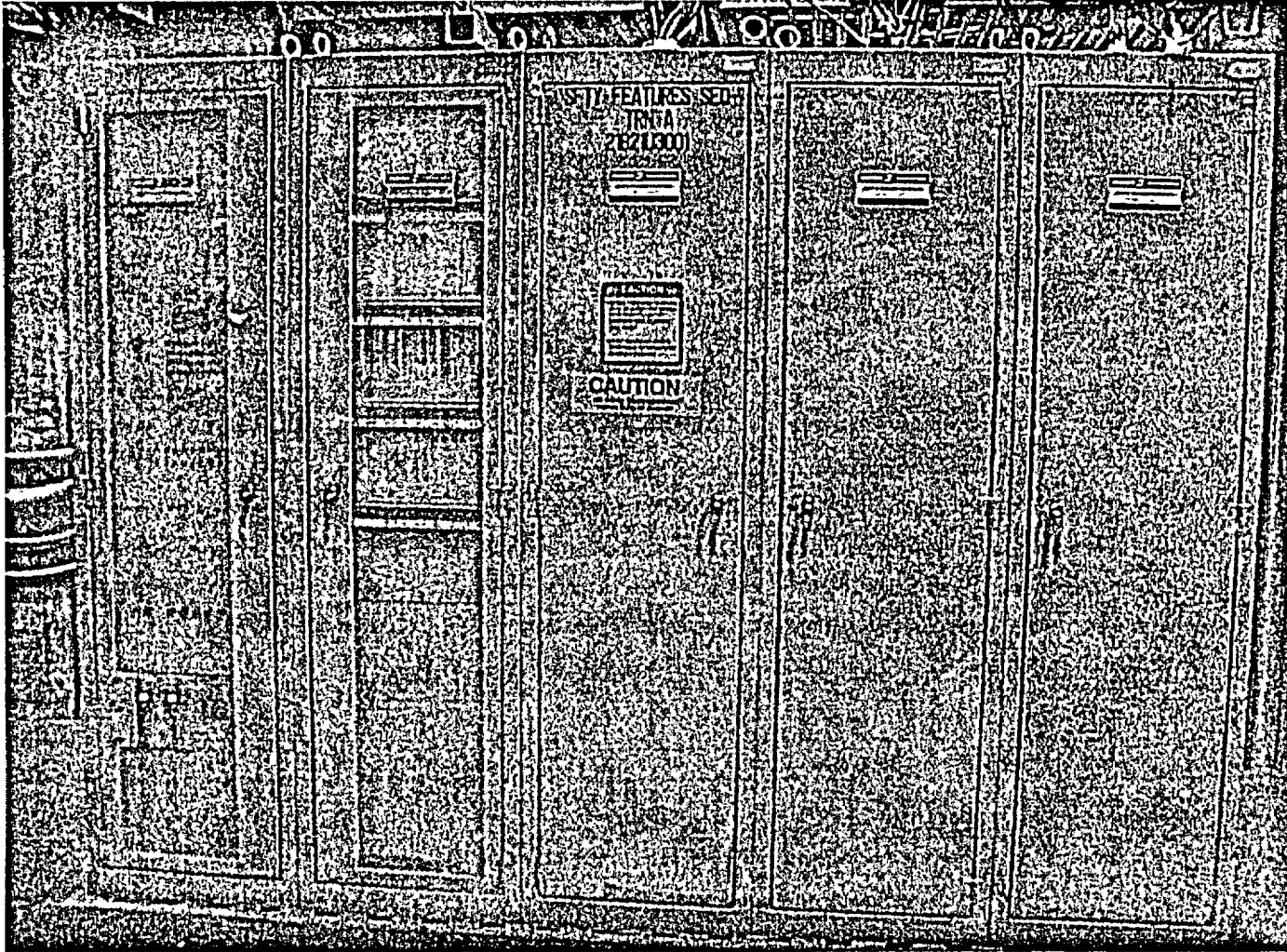
- Actuated on Loss of Vital Bus Voltage or Safety Injection Signal
- Generates Three Sequence Signals
 - SI Only
 - SI and LOSP
 - LOSP Only

Scope of Design Modification

Description of Existing VEGP SFS

- Load Sequence
 - Four Groups - Basic, A, B and C
 - Nine Steps per Group - 0 to 30 seconds in 5 second intervals
- Dedicated Maintenance and Test Panel

View of Existing SFS Cabinets



Scope of Design Modification Description of VEGP SFS Upgrade

- 2-Train System

- Three Channels in Each Train

- * 3 Stand Alone PLCs Per Train - no inter-PLC communication links

- * 2-out-of-3 PLC Redundancy in each Train

- Single PLC failure will not result in spurious actuation

- Single PLC failure will not preclude automatic or manual actuation

- * Voting Performed in Non Software Based Circuits

- Two SFSs per Unit (one per train)

Scope of Design Modification Description of VEGP SFS Upgrade

- Actuated on Loss of Vital Bus Voltage or Safety Injection Signal
- Generates Three Sequence Signals
 - SI Only, SI and LOSP, or LOSP Only
 - Functional Replacement
 - Inputs the same
 - Outputs the same
 - Similar Signalization

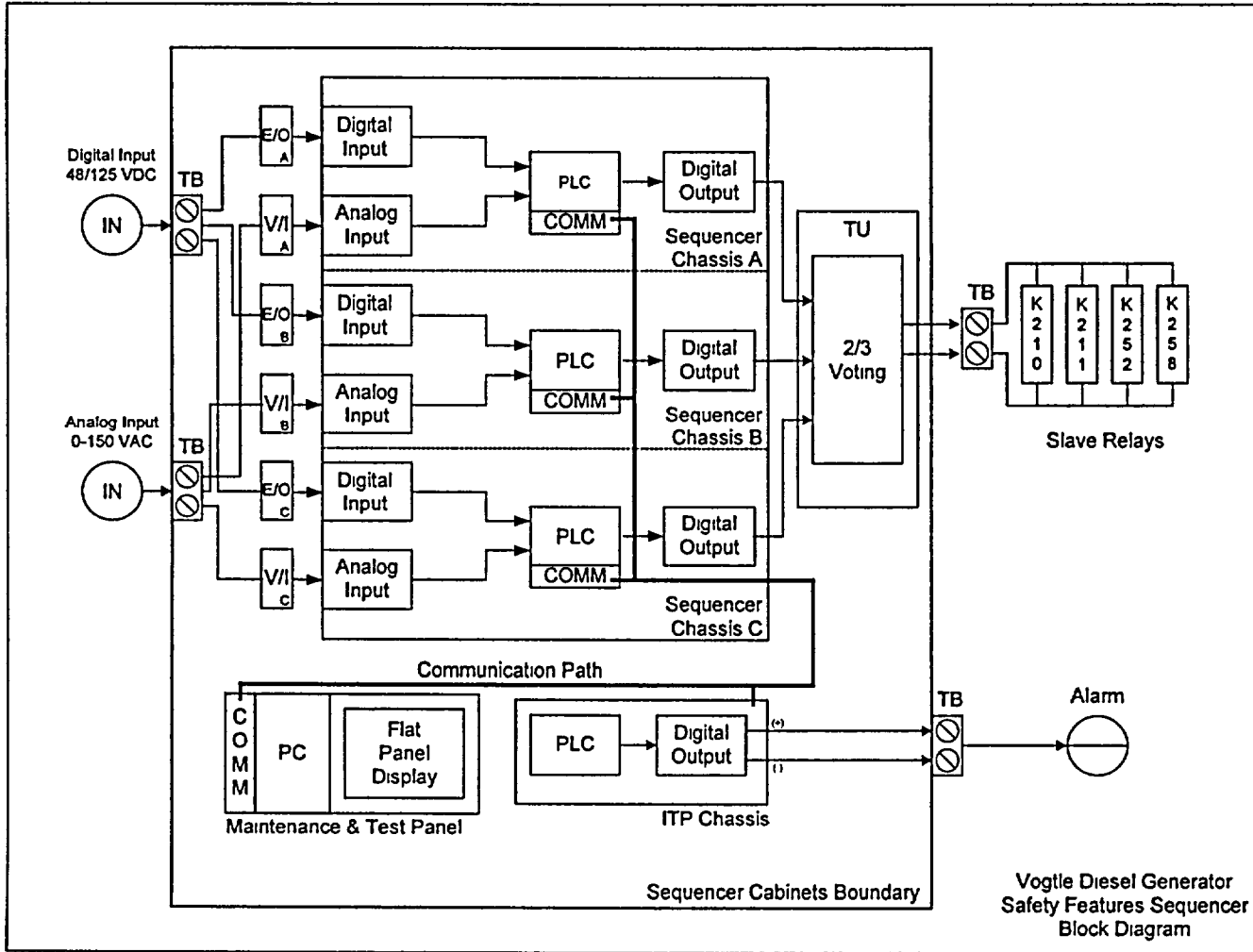
Scope of Design Modification Description of VEGP SFS Upgrade

- Load Sequence
 - Four Groups - Basic, A, B and C
 - Nine Steps per Group - 0 to 30 seconds in 5 second intervals
- FPDS Maintenance and Test Panel

Scope of Design Modification Description of VEGP SFS Upgrade

- Protection Signals Not Impacted
 - All Reactor Trip System (RTS) signals
 - Dedicated MCB component controls
 - ESF system-level actuation signals from SSPS
- ESF Actuation Signal Paths Via SFS
 - LOSP signals
 - Sequencing of SI actuated loads (e.g., rotating machinery)

VEGP SFS Upgrade Architecture



Unique Common Q Circuits associated with SFS Upgrade

- 2-out-of-3 voting logic performed in non software based circuits
- Termination unit special circuits (pulse, interlock circuit)

VEGP SFS Upgrade Licensing Evaluation

- Key Regulatory/Industry Guidelines
 - NEI 01-01 (EPRI TR-102348, Revision 1)
 - NEI 96-07, Revision 1
 - BTP HICB 19
 - NUREG/CR-6303
- Applicability of Common Q SER
- Diversity & Defense-in-Depth Analysis (D3)
- Evaluation of FSAR Chapter 15 AOOs and DBEs

VEGP SFS Upgrade Licensing Evaluation

- License Amendment Request vs. 10 CFR 50.59
 - Design modification “screens in” consistent with NEI 96-07
 - Example 4-8 of NEI 01-01 supports VEGP sequencer upgrade - concludes prior approval not required

VEGP SFS Upgrade Licensing Evaluation

- Key 10 CFR50.59 Questions
 - Does the proposed activity result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the FSAR?
 - Does the proposed activity result in more than a minimal increase in the likelihood of occurrence of a malfunction of an SSC important to safety previously evaluated in the FSAR?
 - Does the proposed activity create the possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the FSAR?

VEGP SFS Upgrade Licensing Evaluation

- 10 CFR 50.59 Evaluation

- D&D-in-D analysis performed prior to 10 CFR 50.59 evaluation

- * Analysis performed as part of design phase

- * Postulated software common mode failure beyond design basis of plant

- * SER Issued by NRC on Common Q System

VEGP SFS Upgrade Licensing Evaluation

- 10 CFR 50.59 Evaluation(continued)
 - D-G Sequencer I&C Upgrade Features Simple Architecture
 - *Three stand alone PLCs per Train With 2-out-of-3 Voting in Non Software Based Circuits
 - *No inter-PLC communication links for actuation path

VEGP SFS Upgrade Licensing Evaluation

- Applicability of Common Q SER
 - Update on Status of Generic SER Open Items (GOIs)
 - Response to Plant Specific Action Items (PSAIs)

Status of Generic SER Open Items

- Following Open Items Closed by Revision 1 of SER
 - 7.4 Section 4.2.1.2
 - 7.7 Section 4.3.1.j
 - 7.9 Section 4.4.4.3.4
 - 7.10 Section 4.4.4.3.5

Status of Generic SER Open Items

- Following SER Open Items Related to Completion of the Common Q Equipment Qualification Program. All EQ Testing Has Been Completed and Additional Information Has Been Filed in August 2002 to Close Out These Items.
 - 7.1 Section 4.1.1.1.2
 - 7.2 Section 4.1.4
 - 7.3 Section 4.1.5
 - 7.5 Section 4.2.2.1.3
 - 7.6 Section 4.2.2.2

Status of Generic SER Open Items

- This Open Item Will Be Addressed in a Future Submittal to the NRC.
 - 7.8 Section 4.4.4.3.2 - Diversity of loop controllers- Not Applicable to VEGP

Status of Plant Specific Action Items

- The Plant Specific Action Items are addressed as follows:
 - 6.1 SNC ensures hardware meets environmental and performance requirements via purchase specifications.
 - 6.2 SNC will use the Westinghouse FPDS.
 - 6.3 This item closed in SER, revision 1. The Westinghouse FPDS is used only for alarm, indication, and test. It is not required to function as part of the sequencer safety function.
 - 6.4 See the response to item 6.1 above.

Status of Plant Specific Action Items (Cont'd)

- 6.5 SNC will rely on the Westinghouse software life-cycle process.
- 6.6 SNC and Westinghouse have performed a timing sensitivity study, and we have determined that the response time of the digital system is adequate.
- 6.7 The OM panel is not being used for the VEGP SFS upgrade. SNC and Westinghouse will develop the MTP to duplicate existing test panel function. Westinghouse and SNC will ensure the MTP incorporates human factors considerations.

Status of Plant Specific Action Items (Cont'd)

- 6.8 The digital sequencer is designed to provide the same functionality as the existing sequencer.
- 6.9 Not Applicable. No Technical Specification changes will result from this modification
- 6.10 A FMEA is being prepared as part of the standard SNC design process.
- 6.11 A Diversity and Defense-in-Depth analysis being performed as part of the design process.

Status of Plant Specific Action Items (Cont'd)

- 6.12 The sequencer upgrade will be subjected to rigorous factory acceptance testing and routine periodic surveillance testing thereafter.
- 6.13 This item is not applicable to this modification.
- 6.14 TMI actions are not impacted by this modification.

Summary of Licensing Evaluation

- Adopted 10 CFR 50.59 licensing approach
- D3 analysis performed as part of design process
- Modification to Design to Resolve Potential Software CMF Susceptibility

Diversity and Defense-in-Depth (D3) Analysis

- Followed Guidelines presented in HICB-19, NUREG/CR-6303 and Reg Guide 1.174
- Developed simplified functional model of SFS
- Identified common software blocks
- Single failure assumed to be CMF in a common software block

Diversity and Defense-in-Depth (D3) Analysis

- All common software blocks assumed to fail to same mode (fail high, fail-as-is, or fail low)
- No other single failures assumed
- Only one initiating event assumed concurrent with postulated software CMF (LOSP is an ANS Condition II event)

Evaluation of FSAR Chapter 15 AOOs and DBEs

- Best estimate initial conditions and assumption assumed
 - Nominal operating conditions
 - ANS best estimate decay heat model
 - Best estimate break flow model (Henry-Fauske)
 - NSSS control systems function normally
 - Relaxed acceptance criteria specified in NUREG/CR-6303 adopted

Evaluation of FSAR Chapter 15 AOOs and DBEs

- Best estimate operator action times assumed
 - Diverse process indications available
 - Diverse system/component controls available
- Use of “Risk-Informed” Insights
 - Low probability of occurrence initiating events not required to be analyzed
 - Only analyzed initiating events identified as significant contributors (at least 1%) to plant CDF and/or LERF using NRC qualified codes

Evaluation of FSAR Chapter 15 AOOs and DBEs

- Use of VEGP PRA Results
 - Total CDF of $\sim 1.6 \text{ E-}05$
 - All initiating events with contribution to CDF less than $1.6 \text{ E-}07$ not evaluated - less than 1%
 - * LOSP initiating events contribute $\sim 11\%$ total CDF and 1% total LERF
 - * LOCA initiating events contribute $\sim 7\%$ total CDF and 2% LERF
 - * SGTR initiating events contribute $\sim 0.5\%$ total CDF and $\sim 10\%$ LERF

Evaluation of FSAR Chapter 15 AOOs and DBEs (Cont'd)

- Contributions to CDF From Component Cutsets
 - SFS failure ~2%of total CDF (excluding sensors and switchgear)
 - RTS & ESF failure ~1% total CDF (excluding sensors, slave relays and switchgear)

Evaluation of FSAR Chapter 15 AOOs and DBEs

- ANS Condition II Events
 - ATWS Mitigation System diverse from SFS
 - *Turbine trip on low-low SG level
 - *Auxiliary feedwater system actuation on low-low SG level
 - Generic ATWS analyses part of VEGP licensing basis
 - Only initiating event that is a significant contributor to CDF or LERF is LOSP
 - *Turbine driven auxiliary feedwater pump actuated independent of SFS
 - Inadvertent Safety Injection event precluded by SI signal interlock directly from SSPS

Evaluation of FSAR Chapter 15 AOOs and DBEs

- ANS Condition III Events

- Only event that is a significant contributor to CDF or LERF is LOCA

- Small Break (SBLOCA)

- Medium Break (MBLOCA)

- VEGP Leak-before-Break licensing basis

- RCS hot leg - 6 inch

- RCS cold leg - 4 inch

- Pressurizer steam space - 6 inch

Evaluation of FSAR Chapter 15 AOOs and DBEs

- ANS Condition III Events (Cont'd)

- Sensitivity studies conducted on NRC approved code (NOTRUMP)

- * 2 inch LOCA - passive accumulator injection not required

- + Operator has >10 minutes to manually actuate ECCS

- * 6 inch break - RCS pressure decreases below passive accumulator setpoint

- + Operator has >10 minutes to manually actuate ECCS

Evaluation of FSAR Chapter 15 AOOs and DBEs

* 4 inch break - RCS pressure remains sufficiently high such that ECCS injection flow decreased - tradeoff of loss of RCS break flow versus ECCS reduced injection flow

+ Operator has >10 minutes to manually actuate ECCS

Evaluation of FSAR Chapter 15 AOOs and DBEs

- ANS Condition IV Events

- LBLOCA not required to be analyzed due to VEGP Leak-before-Break licensing basis

- Only event that is significant contributor to CDF or LERF is SGTR

- *If SFS fails to sequence loads (fails low), event bounded by FSAR analysis

- *If SFS outputs fail high, actuation precluded by design feature of upgrade and also interlock directly from SSPS signal, event bounded by FSAR analysis

AOO and DBE Evaluation Summary

- All FSAR Chapter 15 Events Evaluated
 - Low probability events not required to be evaluated (Condition IV) - LBLOCA
 - Used risk-informed insights to justify only evaluating events that are significant contributors to VEGP CDF and/or LERF (Condition III and IV)
 - *SBLOCA, MBLOCA, SGTR
 - *Analyzed bounding events using NRC qualified code
 - *Greater than 10 minute operator action required to actuate ECCS following LOCA
 - * SGTR results bounded by FSAR analysis

AOO and DBE Evaluation Summary

–Referenced existing bounding plant or generic analysis to greatest extent possible (Condition II)

* Applied ATWS analysis to all Condition II events

Summary

- Adopted 10 CFR 50.59 licensing approach
- D3 analysis performed as part of design process
- Modification to design to resolve potential software CMF susceptibility
- All VEGP Chapter 15 events evaluated concurrent with software common mode failure using risk insights- BTP HICB-19, NUREG/CR-6303, and Reg Guide 1.174.