

*Central  
File*



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

May 13, 1991

Docket Nos. 50-315  
and 50-316

LICENSEE: Indiana Michigan Power Company  
FACILITIES: Cook Units 1 and 2  
SUBJECT: SUMMARY OF MEETING WITH D.C. COOK REGARDING THE PROPOSED  
REPLACEMENT OF REACTOR PROTECTIVE SYSTEM INSTRUMENTATION  
UNDER A 10 CFR 50.59 REVIEW (TAC 80119)

The staff met with the licensee for the Donald C. Cook facility (Indiana Michigan Power Company) and representatives from Asea Brown Boveri - Combustion Engineering (ABB-CE) on April 29, 1991. The purpose of the meeting was to discuss the licensee's proposed replacement of portions of the existing Reactor Protection and Control Process Instrumentation, as manufactured by Foxboro, with similar instrumentation as manufactured by ABB-CE Taylor. Enclosure 1 is the list of attendees; and, Enclosure 2 is a copy of the licensee presentation slides.

BACKGROUND

D.C. Cook cited several factors that created the need to replace the Foxboro H-Line Instrumentation in their Reactor Protection System (RPS). These include:

- 1) NRC Information Notice 86-52, Conductor Insulation Degradation on Foxboro Model E Controllers, which informed that Foxboro Equipment may need refurbishment or replacement;
- 2) INPO Report No. 87-022, which identified aging problems that, in some cases, were precursors to failure;
- 3) D.C. Cook experience and historic trends with the existing hardware that showed increased drift, increased difficulty in calibration, and increased failures; and,
- 4) Foxboro's notification that the H-Line products would cease being available after 1989 and all product support would be withdrawn in 1993.

As a result of the above, D.C. Cook committed to replacement of this hardware, to be accomplished prior to full product support withdrawal and potential unacceptable equipment performance.

DISCUSSION

The licensee's presentation (see Attachment 2) reviewed three major areas:

- a) the present RPS Instrumentation and the problems associated with the as-installed RPS Instrumentation,

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May 13, 1991

- b) the details of the proposed changeout including the new instrumentation, and
- c) the reasoning for the replacement under a 10 CFR 50.59 review.

A copy of the 10 CFR 50.59 safety evaluation performed by the licensee for the proposed RPS Instrumentation replacement project was requested by the staff. The licensee committed to sending a copy of the safety evaluation to the Project Manager within a week.

It was decided that a visit of the vendor's (ABB-CE) facility by the staff would be necessary to facilitate the audit of the licensee's 10 CFR 50.54 safety evaluation. Attachment 3 lists the proposed staff members to participate in the visit and the major areas of review. The visit will be of the vendor's facility at Windsor Locks, Conn., during the week of June 10, 1991.

Further discussions with the licensee will be scheduled after the licensee's 10 CFR 50.59 safety evaluation has been examined by the staff and after the visit to the vendor's facility has been completed. These discussions will focus on any questions which may arise following the staff's visit to the vendor's facility and after the staff's audit of the licensee's safety evaluation. There may also be followup on questions raised during the above referenced meeting.



C. E. Carpenter, Project Engineer  
Project Directorate III-1  
Division of Reactor Projects III/IV/V  
Office of Nuclear Reactor Regulation

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May 13, 1991

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original signed by by C. E. Carpenter

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 Project Directorate III-1  
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[COOK MTG. SUMMARY 4/29]

ATTENDANCE LIST

<u>NAME</u>	<u>ORGANIZATION</u>	<u>TELEPHONE NUMBER</u>
L. B. Marsh	NRC/NRR/PD31	(301) 492-1340
T. G. Colburn	NRC/NRR/PD31	(301) 492-1340
C. E. Carpenter	NRC/NRR/PD31	(301) 492-1347
W. D. Pegg	NRC/NRR/PD31	(301) 492-1362
S. Newberry	NRC/NRR/SICB	(301) 492-0821
J. L. Mauck	NRC/NRR/SICB	(301) 492-3248
G. E. Garten	NRC/NRR/SICB	(301) 492-0931
S. J. Brewer	AEPSC/NS&L	(614) 223-2020
R. A. Kraszewski	AEPSC/NS&L	(614) 223-2029
W. G. Sotos	AEPSC/I&C	(614) 223-1917
R. C. Carruth	AEPSC/I&C	(614) 223-1960
R. F. Kroeger	AEPSC/ESD MGR	(614) 223-1920
M. P. Ryan	ABB-CE	(203) 285-9281
C. B. Brinkman	ABB-CE	(301) 881-7040

# COOK NUCLEAR PLANT

## FOXBORO H-LINE INSTRUMENTATION REPLACEMENT

APRIL 29, 1991

REACTOR PROTECTION AND  
CONTROL PROCESS INSTRUMENTATION  
REPLACEMENT PROJECT

# SCOPE OF REPLACEMENT

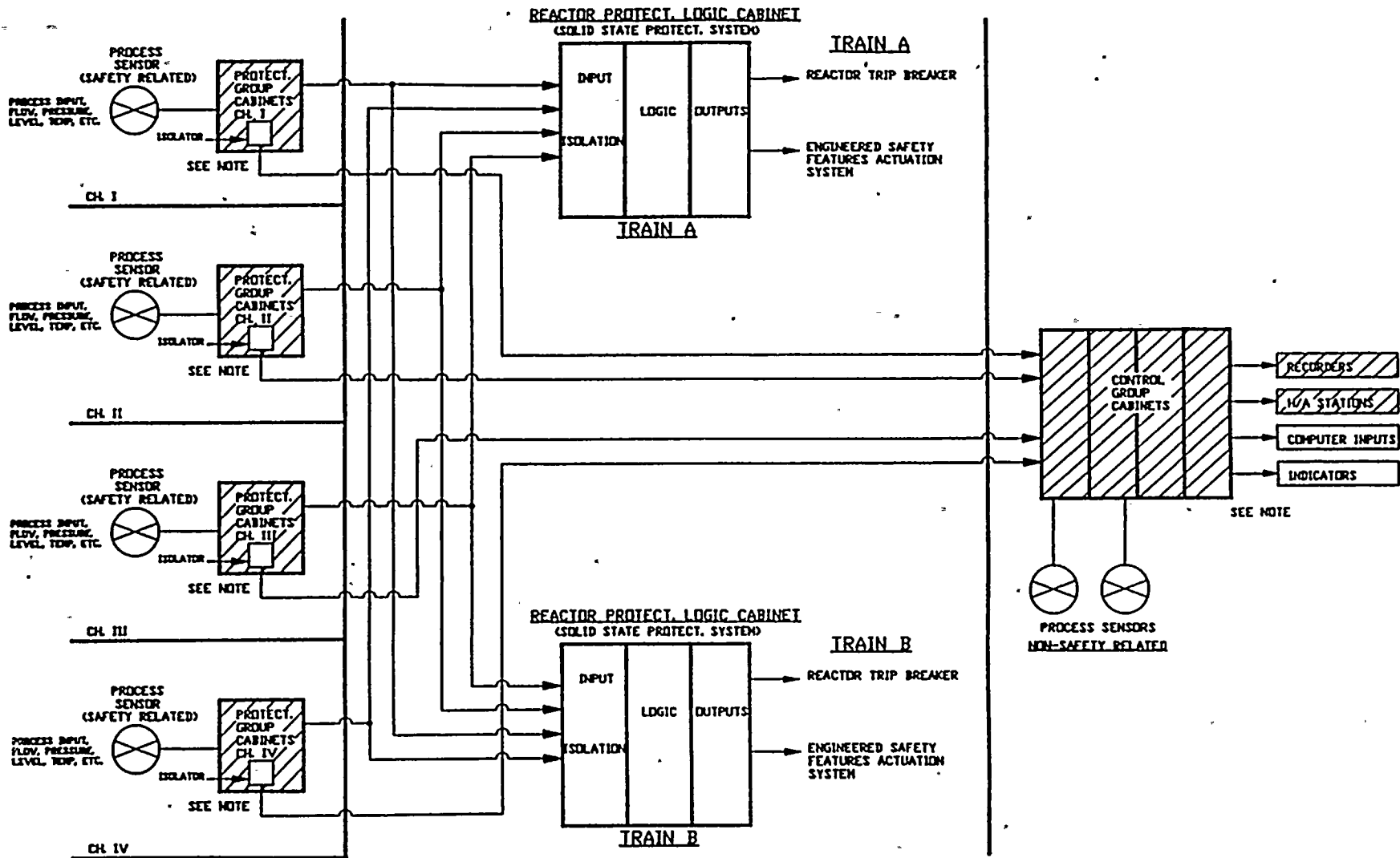
- PRIMARLY THE FOXBORO H-LINE PORTION OF THE REACTOR PROTECTION AND CONTROL SYSTEM





# SAFETY RELATED

# NON-SAFETY RELATED



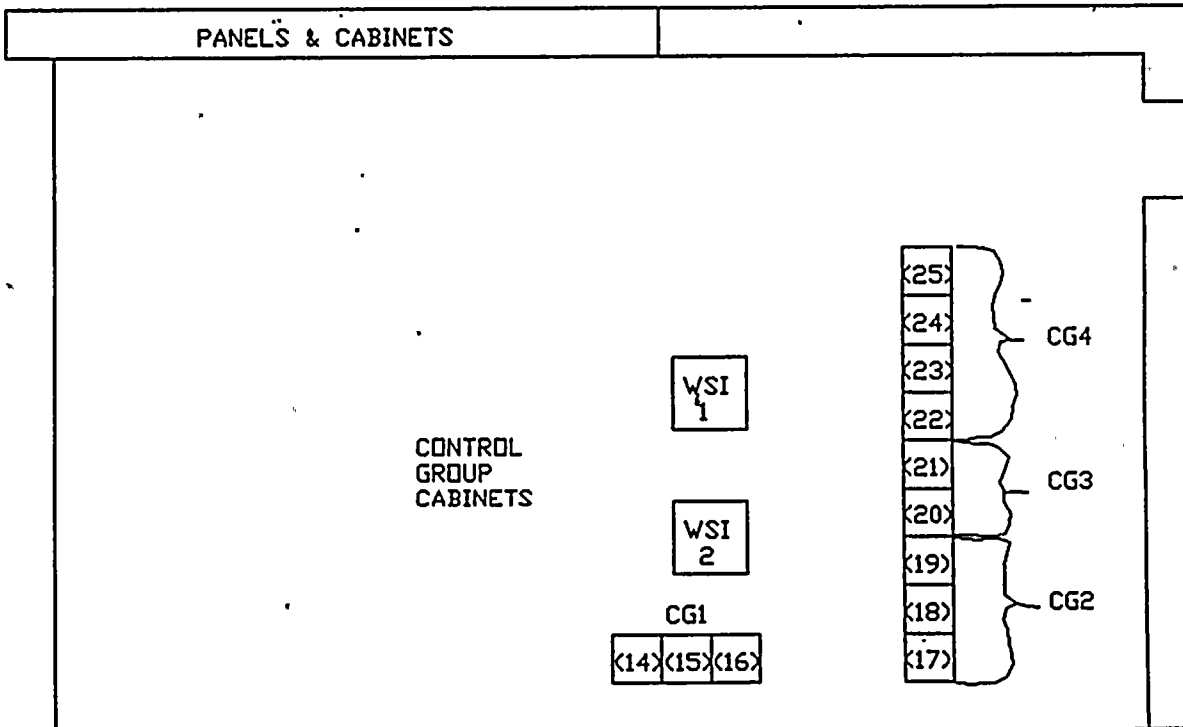
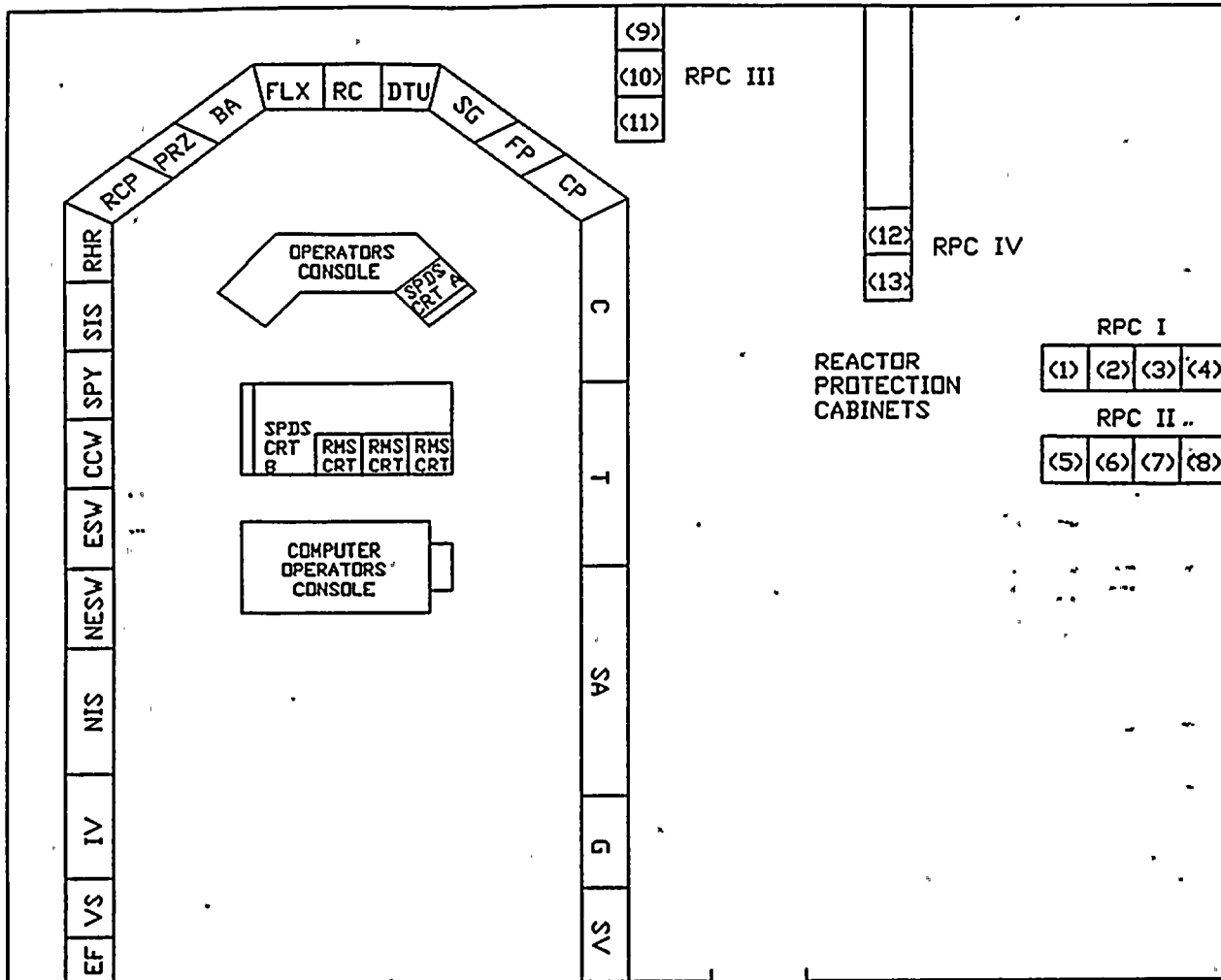
COOK NUCLEAR PLANT

NOTE: ONLY CONTENTS WITHIN THE SHADED AREA RECEIVE UPGRADING

# THIS FOXBORO INSTRUMENTATION IS CONTAINED IN:

- 13 REACTOR PROTECTION CABINETS
- 12 CONTROL CABINETS
- 2 MISCELLANEOUS CABINETS
- ASSOCIATED CONTROL PANEL DISPLAYS  
AND CONTROLS

# D.C. COOK MAIN CONTROL ROOMS (UNIT ONE & TWO TYPICAL)



# WHY REPLACEMENT IS BEING MADE:

- RELIABILITY
- AGE-RELATED PROBLEMS
- AVAILABILITY OF REPLACEMENT PARTS
- LACK OF SUPPORT
- TECHNOLOGICAL ADVANCES

# REASONS WHY WE CAN DO REPLACEMENT UNDER 10 CFR 50.59

- NO IMPACT ON  
TECHNICAL SPECIFICATIONS
- LIMITED IMPACT ON UFSAR
- DOES NOT CONSTITUTE  
AN UNREVIEWED SAFETY  
QUESTION

# Reactor Protection System

- Field Sensors (Transmitters, RTD's, etc)
  - \* Signal Processing Instrumentation (power supplies, square root converters, dynamic compensators, bistables, isolators, etc.)
  - Solid State Protection System (SSPS) - contains logic input and output relays, undervoltage trip devices, test alarms, and multiplexing
  - Reactor Trip Breakers
  - Engineered Safety Feature Actuation System (ESFAS)
- \* Scope of Equipment Change Out

# Problem Description

- NRC notification (IEN 86-52)
- INPO Report No. 87-022 - precursors to failure
- Our own experience/history with (Foxboro H-Line)
- Foxboro's notification that the H-Line would not be available after 1989 and product support will be withdrawn in 1993.



# Scope of Work

- Safety Related - (Reactor Protection)

Remove and replace existing analog signal processing instrumentation with new digital based equipment in the 13 Reactor Protection Cabinets located in the Control Room. Existing cabinets are to be refitted. No functional changes. Field wiring is not to be modified except at the cabinets on a limited basis.

- Non-Safety Related - (Process Control)

Remove and replace existing analog signal processing instrumentation with new digital based equipment in the 12 Control Group Cabinets, two (2) Miscellaneous Cabinets and 60 associated Control Panel Instruments (Recorders, Hand-Auto Stations). No functional changes. Field wiring is not to be modified except at the cabinet on a limited basis.

# Upgrade - Hardware

- Modern Design
- Proven Performance (the product has been in use since the early 1980's)
- High confidence level that equipment will perform reliably with minimum maintenance

# Implementation Concepts

- Extensive AEPSC detailed Engineering/Design involvement including human factors
- No functional changes
- No Technical Specification Changes
- Use of existing field wiring
- All module to module signals are hard wired analog
- Extensive factory acceptance testing prior to shipment
- Thorough Post Installation Testing prior to service
- Thorough formal training for Cook Nuclear Plant operators, technicians, engineers

# Existing Hardware

- Foxboro H-Line
- Electronic analog, rack mounted
- Hundreds of models
- Originally introduced early 1960's
- Installed at Cook Nuclear Plant in the early 1970's
- Control algorithms accomplished by combining modules
- Accuracies ( $\pm 0.5\%$  typical except bistables which are  $\pm 0.25\%$ )
- Performance characteristics are typical for analog instrumentation
- Loop power supplies are not shared between loops

# New Hardware

- Taylor MOD 30 line of instrumentation
- ABB Combustion Engineering is the prime equipment vendor
- MOD 30 products used are: controllers, math units, interposing relays (solid state), and recorders
- The interposing relays provide the necessary bistable output interface to SSPS, alarms, etc.
- Controllers and Math Units have an accuracy of  $\pm 0.1\%$  with virtually no drift
- Controllers, math units and recorders are configurable by embedded firmware
- Module software is controlled by ABB CE - Taylor
- There is no user accessible software
- MOD 30 instruments and loop transmitter power supplies redundant within a protection channel
- Isolation of analog signals is performed using I / I converters by Devar



# Specification

- New equipment to be installable in existing racks using existing field wiring and field instrumentation
- New equipment to functionally replicate existing equipment
- Signal levels are to be compatible
- Compliance with the following standards:
  - IEEE 279-1971
  - IEEE 338-1987
  - IEEE 379-1988
  - IEEE 384-1981
  - IEEE 420-1982
  - IEEE 603-1980

# Equipment Performance

- Accuracy better than  $\pm 0.5\%$ , repeatability of 0.1% or better
- Ability to remain within the published calibrated accuracy for a minimum of 24 months under normal conditions
- AC power requirement no more than original equipment
- Inrush current from energization transients to be kept within inverter design limits
- Time response requirements unchanged for loops with Technical Specifications requirements



# Operation/Surveillance Testing/Maintenance

- Protection set design change is transparent to the operators
- Human factors addressed for control equipment (Hand/auto stations and recorders)
- Surveillance test methods essentially unchanged
- No automatic surveillance test functions
- Reduced maintenance:
  - Improved performance
  - Fewer modules
  - Fewer user adjustments
  - Improved documentation
- Reduced spare parts inventory

# Isolation

- Based on the maximum credible voltage available in the control room
- Isolation is equal to or better than that presently provided
- Existing independence and separation requirements for 1E circuits and equipment are maintained

# Qualification

- EMI/RFI qualification testing per MIL-STD-461 and MIL-STD-462
- Environmental qualification testing for extreme Control Room conditions (Temperature and Humidity) per IEEE 323-1974
- Seismic qualification testing that envelopes Cook Nuclear Plant OBE and DBE levels per IEEE 344-1975
- Firmware Verification and Validation is per applicable portions of ANSI/IEEE-ANS-7-4.3.2-1982 for safety related applications
- Qualification Testing done using replicate Cook Nuclear Plant racks

# Acceptance

- 2000 hour burn-in of 100% of the equipment supplied
- Full visual, continuity, and integrated functional checkout with AEPSC/COOK participation
  - Calibration checks (individual components)
  - 5 point loop calibration checks
  - Proper control actions
  - Proper internal diagnostic actions (watchdog timer)
  - Failure modes (power down)
  - Recovery modes (power up)
  - Checks for correct ranges, setpoints, constants, etc.
  - Dynamic Responses
  - Time response (where applicable)
- Inputs and outputs to the cabinets are to be simulated to replicate existing Cook Nuclear Plant devices

# General

- Control and management of the configuration
- Cook Nuclear Plant Simulator modifications to be made prior to the installation of this equipment

## Schedule

- Installation planned for the next refueling outage on both units
  - Unit 2 - February, 1992
  - Unit 1 - September, 1992
- AEPSC drawings near completion
- Other supporting documentation (calculations, analyses, etc.) being compiled
- Vendor configuration documentation presently under AEPSC review
- Qualification testing virtually completed
- Equipment burn-in near completion
- Plant installation planning is ongoing
- Plant procedure revision is in progress
- Personnel training courses presently under development - classes scheduled for September thru November 1991
- Acceptance testing & Post installation testing procedures presently being developed

## Summary

- The only safety related equipment impacted by this design change is the Reactor Protection signal processing instrumentation located in racks in the Control Room
- This change was driven by NRC, INPO, Vendor and AEPSC/Cook concerns about aging, reliability, performance and parts availability
- No functional changes - equipment replicates the existing equipment's functionality
- Existing racks and field cables are used
- New equipment will be more accurate, stable, and reliable
- Qualification for EMI/RFI, environmental, and seismic completed with satisfactory results
- Firmware Verification & Validation by the vendor to the applicable industry standard
- Full Factory Acceptance Testing under AEPSC Engineering supervision
- No Technical Specification or significant FSAR changes are needed
- Installation planned for both units during 1992 refueling outage



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**10 CFR 50.59(a)(1)**  
**AUTHORIZES THE LICENSEE TO:**

- **MAKE CHANGES IN THE FACILITY AS DESCRIBED IN THE SAFETY ANALYSIS REPORT**
- **MAKE CHANGES IN THE PROCEDURES AS DESCRIBED IN THE SAFETY ANALYSIS REPORT**
- **CONDUCT TESTS OR EXPERIMENTS NOT DESCRIBED IN THE SAFETY ANALYSIS REPORT**

**WITHOUT PRIOR NRC APPROVAL AS LONG AS THE CHANGE, TEST OR EXPERIMENT DOES NOT INVOLVE A CHANGE IN TECHNICAL SPECIFICATIONS OR AN UNREVIEWED SAFETY QUESTION**

# REPLACEMENT REQUIRES:

- MINOR UFSAR CHANGES
- NO CHANGES IN OUR TECHNICAL SPECIFICATIONS

**DOES THE PROPOSED ACTIVITY INCREASE THE  
PROBABILITY OF OCCURRENCE OF AN ACCIDENT  
PREVIOUSLY EVALUATED IN THE UFSAR?**

**NO, BECAUSE:**

- **BETTER ACCURACY**
- **SAME FUNCTION**
- **MEETS THE RESPONSE TIMES  
SPECIFIED IN THE T/Ss**

**DOES THE PROPOSED ACTIVITY INCREASE  
THE CONSEQUENCES OF AN ACCIDENT  
PREVIOUSLY EVALUATED IN THE UFSAR?**

**NO, BECAUSE:**

- **NEW INSTRUMENTATION  
IS BETTER AND THEREFORE  
CONSEQUENCES OF ACCIDENT  
WILL NOT BE INCREASED**

**DOES THE PROPOSED ACTIVITY INCREASE THE  
PROBABILITY OF AN OCCURRENCE OF A  
MALFUNCTION OF EQUIPMENT IMPORTANT TO  
SAFETY PREVIOUSLY EVALUATED IN THE UFSAR?**

**NO, BECAUSE:**

- **NEW INSTRUMENTATION  
MEETS OR EXCEEDS THE  
QUALIFICATION OF THE  
FOXBORO LINE.**

**DOES THE PROPOSED ACTIVITY INCREASE THE  
CONSEQUENCES OF A MALFUNCTION OF  
EQUIPMENT IMPORTANT TO SAFETY  
PREVIOUSLY EVALUATED IN THE UFSAR?**

**NO, BECAUSE:**

- **NEW INSTRUMENTATION MEETS OR  
EXCEEDS THE PERFORMANCE CRITERIA  
OF THE FOXBORO LINE**

DOES THE PROPOSED ACTIVITY CREATE THE POSSIBILITY OF AN ACCIDENT OF A DIFFERENT TYPE THAN ANY PREVIOUSLY EVALUATED IN THE UFSAR?

NO, BECAUSE:

- NO NEW FAILURE MODE IS INTRODUCED

**DOES THE PROPOSED ACTIVITY CREATE  
THE POSSIBILITY OF A MALFUNCTION  
OF EQUIPMENT IMPORTANT TO SAFETY  
OF A DIFFERENT TYPE THAN ANY  
PREVIOUSLY EVALUATED IN THE  
UFSAR?**

**NO, BECAUSE:**

- **NO NEW FAILURE MODE  
IS INTRODUCED**





**DOES THE PROPOSED ACTIVITY REDUCE  
THE MARGIN OF SAFETY AS DEFINED  
IN THE BASIS FOR ANY TECHNICAL  
SPECIFICATION?**

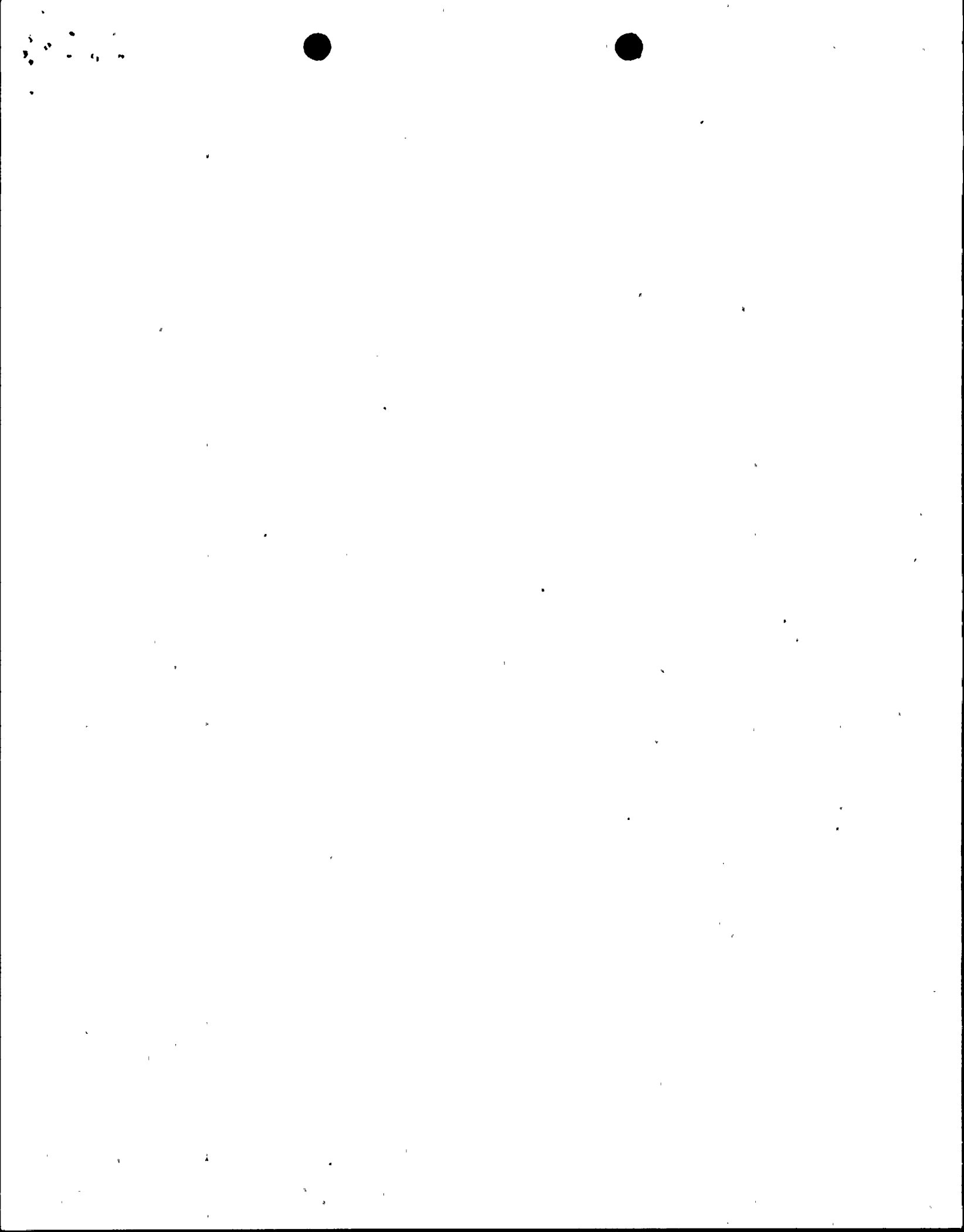
**NO, BECAUSE:**

- **NEW INSTRUMENTATION MEETS  
OR EXCEEDS THE PERFORMANCE  
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FOXBORO LINE**

# CONCLUSION

REPLACE UNDER 10 CFR 50.59 BECAUSE:

- NO IMPACT ON  
TECHNICAL SPECIFICATIONS
- LIMITED IMPACT ON UFSAR
- DOES NOT CONSTITUTE  
AN UNREVIEWED SAFETY  
QUESTION



VISIT TO THE ABB-CE FACILITY TO FACILITATE THE AUDIT  
OF LICENSEE'S 10 CFR 50.59 SAFETY EVALUATION

STAFF ATTENDEES

CECarpenter  
GEGarten  
JLMauck  
NRC Contractor

AREAS OF INTEREST

Validation and Verification Procedures, including all associated Control Documentation

Demonstration of Personal Computer (PC) used for setting instrumentation values

Configuration of PC

Validation and Verification Procedures for the PC Software

Procedures for identifying existing system noise

Validation and Verification Procedures for Commercial Dedication

Testing Procedures & Results for the Isolators

Equipment Environmental Envelope

Battery Profile on Station Blackout

Wyle Test Results

Calibration & Testing Setups Procedures & Results

Overall accomplishment to date

Other Items as necessary

May 13, 1991

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