Docket No. 50-213
B14342

Attachment 1

Haddam Neck Plant

Proposed Revision to Technical Specifications

Modernize Feedwater Control

January 1993

TABLE 3.3-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
8. Steam Flow-High	4 (1/steam line)	2	1/steam line	1, 2	9#
9. Steam Generator Water Level-Low Coincident With Steam/Feedwater Flow Mismatch	3/SG level and 2/steam/feed-water flow mismatch in each SG	2/SG level coincident with 1/steam/feed-water flow mismatch in same loop	2/SG level and 1/steam/feed-water flow mismatch in each SG	1, 2	6#
10. Undervoltage - Reactor Coolant Pumps	2 (1/bus)	1	2 (1/bus)	1[(a)]	8
11. Safety Injection	2	1	2	1, 2	11A

TABLE 3.3-1 (Continued)

ACTION STATEMENTS (Continued)

ACTION 4:

With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, suspend all operations involving positive reactivity changes and restore the inoperable channel to OPERABLE status within 8 hours or open/verify open the Reactor Trip System breakers within the next hour.

ACTION 5:

Action has been deleted.

ACTION 6:

With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed until performance of the next required ANALOG CHANNEL OPERATIONAL TEST provided the inoperable channel is placed in the tripped condition within 6 hours; however, the inoperable channel may be bypassed up to 8 hours for surveillance testing of other channels per Specification 4.3.1.1.

ACTION 7:

With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, reduce THERMAL POWER to below 74% of RATED THERMAL POWER (P-8) within 1 hour and place the inoperable channel in the trip position within the next 8 hours.

ACTION 8:

With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, reduce THERMAL POWER to below 10% of RATED THERMAL POWER (P-7) within 4 hours.

ACTION 9:

With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, STARTUP and/or POWER OPERATION may proceed until performance of the next required ANALOG CHANNEL OPERATIONAL TEST provided that the inoperable channel is placed in the tripped condition within 1 hour.

TABLE 4.3-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
8. Steam Flow--High	S	R(5)	SW	N.A.	1, 2
9. Steam Generator Water Level--Low Coincident with Steam/Feedwater Flow Mismatch	S	R	SW	N.A.	1, 2
10. Undervoltage - Reactor Coolant Pumps	N.A.	R	N.A.	R	1[(a)]
11. Safety Injection	N.A.	N.A.	N.A.	R	1, 2
12. Reactor Coolant Pump Breaker Position Trip	N.A.	N.A.	N.A.	R	1[(a)]
13. Main Steam Line Trip Valve Closure	N.A.	N.A.	N.A.	R	1[(a)]
14. Turbine Trip	N. A.	N.A.	N.A.	R	1[(a)]

TABLE 3.3-2 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO ACTUATE	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
5. Containment Isolation (Containment Air Recirculation System, Feedwater Isolation, Safety Injection)					
a. Containment Pressure-High	4	2	3	1, 2, 3, 4	20, 24
b. Safety Injection	See Item 1. above for all Safety Injection initiating functions and requirements.				
6. Feedwater Isolation					
a. Narrow Range Steam Generator Water Level--High	3/stm. gen. in each operating loop	2/stm. gen. in any operating loop	2/stm. gen. in each operating loop	1	24

TABLE 3.3-2 (Continued)

TABLE NOTATIONS

*Trip function may be bypassed in this MODE when RCS pressure is less than 1800 psig.

**The channel(s) associated with the protective functions derived from the out-of-service reactor coolant loop shall be placed in the tripped mode.

(a) THERMAL POWER above 10% of RATED THERMAL POWER.

(b) For Surveillance Testing, at most only one train may be taken out of service at a time.

(c) Not used.

(d) For surveillance testing purposes, (item 3.a of Table 4.3.2) the minimum channels OPERABLE may be less than those specified in Table 3.3-2 for items 3.a.1 and 3.a.2.

ACTION STATEMENTS

ACTION 20 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

ACTION 21 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, startup and/or power operation may proceed until performance of the next required ANALOG CHANNEL OPERATIONAL TEST provided the inoperable channel is placed in the tripped condition within 1 hour.

ACTION 22 - With a channel associated with an operating loop inoperable, restore the inoperable channel to OPERABLE status within 4 hours or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 23 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUE
4. Emergency Bus Undervoltage		
a. 4.16 kV Bus Undervoltage - Level 1	≥2870** volts	≥[illegible]84** volts
b. 4.16 kV Bus Undervoltage - Level 2	≥3684 volts with a 9 second time delay.	≥3664 volts with a 8 second to 10 second time delay.
c. 4.16 kV Bus Undervoltage - Level 3	≥4019 volts with a 9 second time delay.	≥3999 volts with a 8 second to 10 second time delay.
5. Containment Isolation (Containment Air Recirculation System, Feedwater Isolation, Safety Injection)		
a. Containment Pressure - High	≤4.7 psig	≤5.0 psig
b. Safety Injection	See Item 1. above for all Safety Injection Trip Setpoints and allowable values.	
6. Feedwater Isolation		
a. Steam Generator Water Level--High	≤74% of narrow-range instrument span	≤80% of narrow-range instrument span

* Rated Thermal Power

** Setpoint is by tap position. Time delay of device is inverse function of voltage. Device must change state within 0.95 - 1.05 seconds when the input voltage to the device goes from normal to 50% of the trip setting voltage instantaneously.

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

CHANNEL FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
4. Emergency Bus Undervoltage					
a. 4.16 kV Bus Undervoltage - Level 1	N.A.	R	N.A.	M*	1, 2, 3, 4
b. 4.16 kV Bus Undervoltage - Level 2	N.A.	R	N.A.	M*	1, 2, 3, 4
c. 4.16 kV Bus Undervoltage - Level 3	N.A.	R	N.A.	M*	1, 2
5. Containment Isolation (Containment Air Recirculation System, Feedwater Isolation, Safety Injection)					
a. Containment Pressure --High	D	R	SW	N.A.	1, 2, 3, 4
b. Safety Injection	See Item 1. above for all Safety Injection Surveillance Requirements.				
6. Feedwater Isolation					
a. Steam Generator Water Level--High	S	R	SW	R	1

* Trip actuating device operational test is defined as a test of each individual channel. A complete logic test will be performed on a refueling outage basis. On a monthly basis, an undervoltage condition will be initiated at the sensing device to verify the operability of the trip actuating device and verify that the associated alarm relays operate.

3/4.3.1 and 3/4.3.2 REACTOR TRIP SYSTEM INSTRUMENTATION AND ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

The OPERABILITY of the Reactor Trip System and Engineered Safety Features Actuation System instrumentation and interlocks ensure that: (1) the associated ACTION and/or Reactor trip will be initiated when the parameter monitored by each channel or combination thereof reaches its Setpoint, (2) the specified coincidence logic is maintained, (3) sufficient redundancy is maintained to permit a channel to be out-of-service for testing or maintenance, and (4) sufficient system functional capability is available from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundancy, and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the safety analyses. The Surveillance Requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

The Feedwater Isolation circuit is considered to be OPERABLE provided either the Feedwater Regulating Valve or the Feedwater Isolation MOV is available for automatic closure.

The Engineered Safety Feature Actuation System Instrumentation Trip Setpoints specified in Table 3.3-3 are the nominal values at which the bistables are set for each functional unit. A Setpoint is considered to be adjusted consistent with the nominal value when the "as measured" Setpoint is within the band allowed for calibration accuracy.

To accommodate the instrument drift assumed to occur between operational tests and the accuracy to which Setpoints can be measured and calibrated, Allowable Values for the Setpoints have been specified in Table 3.3-3. Operation with Setpoints less conservative than the Trip Setpoint but within the Allowable Value is acceptable since an allowance has been made in the safety analysis to accommodate this error.

The Engineered Safety Features Actuation System senses selected plant parameters and determines whether or not predetermined limits are being exceeded. If they are, the signals are combined into logic matrices sensitive to combinations indicative of various accidents, events, and transients. Once the required logic combination is completed, the system sends actuation signals to those Engineered Safety Features components whose aggregate function best serves the requirements of the condition. As an example, the following actions may be initiated by the Engineered Safety Features Actuation System to mitigate the consequences of a steam line break

3/4.3.1 and 3/4.3.2 REACTOR TRIP SYSTEM INSTRUMENTATION AND ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION (continued)

or loss-of-coolant accident: (1) Safety Injection pumps start and automatic valves position, (2) Reactor trip, (3) startup of the emergency diesel generators, (4) containment isolation, (5) Turbine trip, (6) auxiliary feedwater pumps start and automatic valves position, (7) containment cooling fans start and automatic valves position, and (8) essential service water pumps start and automatic valves position.

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Attachment 2

Haddam Neck Plant

Draft Final Project Description

Modernize Feedwater Control

January 1992

ED3463-2 REV 2-84

PAGE	PROJECT ASSIGNMENT NO.	REV. NO.
1 OF 81	90-013	0

Northeast Utilities Service Company
NUCLEAR ENGINEERING & OPERATIONS
PROJECT DESCRIPTION

PROJECT TITLE

DRAFT

CONNECTICUT YANKEE
MODERNIZE FEEDWATER CONTROL

PROJECT

Please Note that this title page is Page 1 of 81

PREPARED BY: ____________________ Date: ________
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CY Unit Superintendent

AU/WORK ORDER NO.: C2/34890101

2TBS4P.07M

Northeast Utilities Service Company
NUCLEAR ENGINEERING & OPERATIONS
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PROJECT

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CONNECTICUT YANKEE
MODERNIZE FEEDWATER CONTROL

PROJECT

1.0 PROJECT SCOPE

This project continues the Connecticut Yankee instrumentation modernization effort by replacing the existing obsolete Hagan Feedwater Control System instrumentation with a state-of-the-art digital upgrade. The project goals are to increase system reliability and plant availability while improving the plant's design adherence to current industry standards. The scope of the project includes the following:

1) The replacement of the eight Steam Generator feedwater flow transmitters (FT-1301-1A, -2A, -3A, -4A, -1B, -2B, -3B, -4B) with eight redundant Class 1E, 4-20 mA equivalents (FT-1301- 1B, -2B, -3B, -4B, -1C, -2C, -3D, -4D).

2) The replacement of the four Steam Generator steam flow transmitters (FT-1201-1, -2, -3, -4) with eight redundant Class 1E, 4-20 mA equivalents (FT-1201-1B, -2B, -3B, -4B, -1C, -2C, -3D, -4D).

3) The replacement of the four steam generator narrow range level transmitters (LT-1301-1, -2, -3, -4) with twelve redundant Class 1E, 4-20 mA Steam Generator narrow-range level transmitters. (There will be twelve total; three per loop.) This will include the relocation of existing temporary steam generator narrow-range level circuitry from the Reactor Protection Cabinets to the secondary-side Reactor Protection Cabinets (LT-1301-1A, -2A, -3A, -4A, -1C, -2C, -3C, -4C, -1D, -2D, -3D, -4D).

4) The replacement of the four Steam Line Break flow transmitters (FT-1202-1, -2, -3, -4) with four redundant Class 1E, 4-20 mA equivalents (FT-1202-1, -2, -3, -4)

5) The replacment of the four containment mounted Steam Generator pressure transmitters (PT-1201-1, -2, -3, -4) with four redundant Class 1E, 4-20 mA Steam Generator pressure transmitters (PT-1201-1B, -2B, -3B, -4B). The existing Steam Generator pressure transmitters

mounted in the terry turbine building (PT-1201-1B, -2B, -3B, -4B) will be renamed (PT-1201-1C, -2C, -3D, -4D).

6) The replacement of Steam Flow/Feed Flow mismatch Reactor Trip circuitry with solid state equipment and suitable field interface.

7) The replacement of Steam Line Break Reactor Trip circuitry with solid state equipment and suitable field interface.

8) The replacement of Steam Generator Water Level Control circuitry with solid state equipment and suitable field interface.

9) The replacement and addition of Main Control Board mounted equipment associated with the above changes (indicators, recorders, controllers, etc...), as well as the replacement of the Steam Generator wide-range level indicators and the Auxiliary Feed Flow indicators.

10) The addition of on-line testing capability for the above Reactor Trip input circuitry.

11) The enhancement of the Steam Generator overfill protection circuitry including the automatic closure of the feedwater isolation motor operated valves (FW-MOV-11, -12, -13, -14) as well as the feedwater regulating valves (FW-FCV-1301-1, -2, -3, -4).

12) The addition of automatic control for the feedwater bypass valves for automatic steam generator level control at lower power levels.

13) The replacement of Vital Inverters A and B with two Class 1E 5 kVA inverters and backup transformers.

14) This project will interface with Plant Design Change 1319, Feedwater Bypass Flow Modifications, which will

provide a bypass flow measurement of 0-600 GPM. This project will replace the control board indicators and provide additional wiring for the bypass flow input to the Feedwater Control cabinets.

2.0 NUCLEAR ENGINEERING AND OPERATIONS GROUP INTERFACES

2.1 Engineering

2.1.1 Project Engineer

a) Prepare and revise the Project Assignment and Project Description.

b) Coordinate the preparation of the Project Budget and Project Schedule.

c) Prepare and revise Project Equipment Specifications.

d) Interface with vendors to provide supplemental design criteria.

e) Review and approve preliminary and final drawings (functional, logic, schematic, wiring, P&ID, and equipment installation).

f) Coordinate the preparation, review, and approval of the Project Materials Lists.

g) Coordinate the preparation, review, and approval of Purchase Requisitions. Submit quality related electrical purchase requisitions to NUSCO Procurement Engineering for review and approval.

h) Prepare the PDCR and coordinate the review, approval, and submission to the CYAPCO Engineering Manager.

i) Initiate appropriate Technical Specification Change Requests.

j) Coordinate the preparation, review, and approval of Safety Evaluations.

k) Review and approve vendor test procedures and witness the Facility Acceptance Test.

l) Provide outage support for project implementation.

m) Review and approve as-built drawings and transmit to design.

n) Prepare Turnover Documentation.

o) Prepare documentation in support of PDCR close-out (FSAR change, MEPL, Recommended Spare Parts, and PMMS updates).

p) Perform Project Close-out.

q) Interface with CYAPCO Plant Engineering for preparation of Purchase Requisitions of consumable items (wire lugs, splices, heat shrink tubing, etc.).

2.1.2 NUSCO Electrical Engineering (PSD)

a) Supply detailed instrumentation and control design requirements.

b) Ensure that the instrumentation and control design is in accordance with appropriate codes and standards.

c) Perform independent review and approval of instrumentation and control design documentation.

d) Coordinate all major electrical modifications in the 1993 outage to reduce duplication of effort and define clear boundaries between the various Project Assignments.

e) Specify the electrical design inputs.

f) Determine power requirements and provide sources.

g) Perform loading calculations.

h) Provide technical input to Electrical Design.

i) Review and approve cable routing and electrical drawings.

j) Ensure that the electrical design is in accordance with appropriate codes and standards.

k) Prepare electrical PDCR input.

l) Prepare the Electrical Purchase Requisitions. Submit quality related electrical purchase requisitions to NUSCO Procurement Engineering for review and approval.

m) Prepare the Electrical Safety Evaluation.

n) Perform electrical independent design verification reviews.

o) Review and approve electrical as-built drawings.

2.1.3 NUSCO Civil & Mechanical Engineering (PSD)

a) Specify the civil and mechanical design inputs.

b) Ensure that the civil and mechanical design is in accordance with appropriate codes and standards.

c) Provide technical input to Civil and Mechanical Design.

d) Review and approve equipment mounting drawings.

e) Prepare civil and mechanical PDCR input.

f) Prepare the Civil Safety Evaluation.

g) Perform mechanical independent design verification reviews.

2.1.4 NUSCO Engineering Mechanics (ED)

a) Perform equipment seismic qualification review and approval.

b) Specify seismic design inputs.

c) Specify the seismic design requirements for the installation of instrumentation within the Main Control Room.

d) Specify the seismic design requirements for the installation of transmitter racks and

mounts in the Turbine Building and in Containment.

e) Specify the seismic design requirements for Main Control Board mounted equipment.

f) Ensure that the seismic design is in accordance with appropriate codes and standards.

g) Review and approve Civil and Mechanical drawings.

h) Prepare PDCR input.

i) Perform seismic independent design verification reviews.

j) Review and approve Civil and Mechanical as-built drawings.

2.1.5 NUSCO Civil Engineering (ED)

a) Perform civil independent design verification reviews.

b) Perform structural analysis as required and provide input to PDCR.

2.1.6 NUSCO Stress Analysis (ED)

a) Specify the seismic design requirements for the installation of instrument tubing in Containment.

b) Provide technical review for PDCR input.

2.1.7 NUSCO Electrical and I&C Programs (ED)

a) Specify EEQ design inputs.

b) Ensure that the EEQ design is in accordance with the appropriate codes and standards.

c) Update EEQ documentation.

d) Prepare PDCR input.

e) Perform independent design verification reviews.

f) Review and approve EEQ Walkdown Checklists.

g) Perform Appendix R review of PDCR and update Appendix R compliance report if necessary.

2.1.8 <u>NUSCO Fire Protection and Facilities (ED)</u>

a) Specify design inputs.

b) Perform Fire Protection reviews.

c) Ensure that the design is in accordance with appropriate codes and standards.

d) Prepare PDCR input.

e) Perform independent design verification reviews.

2.1.9 <u>NUSCO Safety Analysis</u>

a) Prepare PDCR input.

b) Prepare the Integrated Safety Evaluation.

2.1.10 <u>NUSCO Probabilistic Risk Assessment</u>

a) Develop and implement the public safety attribute of the Analytic Ranking Model.

b) Evaluate the project for the Integrated Safety Assessment Program (ISAP).

c) Review the Conceptual Project Description with respect to impact of the project on the Corporate Nuclear Safety Goal.

2.1.11 NUSCO Nuclear Licensing

a) Identify regulatory requirements.

b) Review and comment on the Project Description and Design Inputs.

c) Provide liaison with all Regulatory Agencies as required.

d) Coordinate agency review and approval.

e) Coordinate the approval of any Technical Specification Change Requests.

2.1.12 NUSCO Reliability Engineering

a) Perform a Reliability Analysis on the plant modification in accordance with IEEE Standard 577-1976, Section 4.

2.1.13 CYAPCO Health Physics

a) Perform ALARA Design Review.

b) Submit ALARA recommendations.

c) Prepare PDCR input.

2.1.14 CYAPCO Plant Engineering

DRAFT

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a) Coordinate the plant's review of design documents and obtain a consensus of plant opinions for the detailed design.

b) Specify, review, and approve the project's Design Inputs.

c) Coordinate the preparation and performance of test procedures to complete preoperational testing.

d) Review and approve the PDCR and coordinate the PORC approval.

e) Review and comment on vendor drawings.

f) Review and comment on the vendor test procedures and witness the Facility Acceptance Test.

g) Provide outage support for project implementation (coordinate work orders, testing, significant DCN processing, NCRs, etc...).

h) Review the project construction schedule and coordinate plant activities.

i) Ensure that the modification is complete, that all preoperational requirements are complete, and that all open items are identified and tracked.

j) Notify the Shift Supervisor of the Engineering Release for Operation.

k) Coordinate the collection of all as-built drawings.

2.1.15 CYAPCO I&C Engineering

a) Specify, review, and approve the project's Design Inputs.

b) Coordinate the preparation and performance of test procedures to complete preoperational testing.

c) Review and comment on vendor drawings.

d) Review material specifications and the PDCR.

e) Review and comment on the vendor test procedures and witness the Facility Acceptance Test.

f) Coordinate the Software Configuration.

g) Provide outage support for project implementation (coordinate testing and troubleshooting).

h) Review the project construction schedule and coordinate plant activities.

2.1.16 NUSCO Quality Services Department

a) Review and approve material and installation specifications. (NUSCO QSD)

b) Review and approve quality related procurement documentation. (NUSCO PRQS)

c) Perform supplier audits/inspections. (NUSCO PVS)

d) Perform material receipt inspections. (NUSCO PRQS)

e) Perform field surveillances. (NUSCO PRQS/QSD)

f) Coordinate NCR issuance, tracking, and closure. (NUSCO PRQS/QSD)

g) Perform AWO reviews and inspections. (NUSCO QSD)

2.1.17 NUSCO Procurement Engineering

a) Interface with the Project Engineer and Plant Engineer for technical and quality requirements of material, equipment, parts and services.

b) Review and approve all quality related purchase requisitions.

2.2 Design

2.2.1 NUSCO Electrical Design

a) Provide the design and drafting for the preparation and revision of one-line, schematic, wiring, panel layout, and equipment arrangement drawings.

b) Provide the design and drafting for the preparation and revision of loop and logic diagrams.

c) Prepare and issue cable and conduit schedules, duct and trench plans, and raceway plans.

d) Prepare and issue the Electrical Materials List.

e) Review and comment on vendor drawings.

f) Incorporate vendor drawings into the NUSCO system.

g) Prepare and issue the electrical as-built drawings.

h) Provide outage support to facilitate the installation of cable and electrical equipment.

2.2.2 NUSCO Civil & Mechanical Design (PSD)

a) Prepare Civil design calculations.

b) Provide the design and drafting for the preparation and revision of equipment, conduit, cable tray, and tubing support drawings.

c) Prepare and issue the Civil Structural Material List or provide material information on the Civil Drawings.

d) Incorporate and issue the Civil as-built drawings.

e) Provide outage support to facilitate the installation of equipment and instrument tubing.

f) Prepare Mechanical design calculations.

g) Provide the design and drafting for the preparation and revision of Mechanical P&ID, and isometric drawings.

h) Prepare and issue the Mechanical Material List.

i) Prepare and issue the Mechanical as-built drawings.

j) Provide outage support to facilitate the installation of instrument tubing.

2.3 Implementation

2.3.1 NUSCO Generation Construction

a) Review and comment on the project schedule.

b) Review, comment and approve the project construction budget.

c) Transport and install instrumentation cabinets in the Main Control Room.

d) Install new conduit and supports and pull cables in the Turbine Building and Switchgear Room A.

e) Install new conduit and supports and coordinate with Generation Test to pull new cables in the Main Control Room.

f) Install new transmitter racks and mounts.

g) Mount new transmitters.

h) Install conduit and supports and pull new cables in the containment outer annulus.

i) Terminate cables on new equipment.

j) Install instrument tubing and supports.

k) Transport and install new inverters and back-up transformers in Switchgear Room A.

l) Install/repair fire seals.

m) Purchase field materials.

n) Prepare as-built drawings and transmit them to the Plant Engineer.

2.3.2 NUSCO Generation Test

a) Review and comment on the project installation specifications.

b) Coordinate with Generation Construction to pull and terminate all field side cabling in the Main Control Room.

c) Perform modifications to the Main Control Board (component installations, internal board wiring).

d) Prepare as-built drawings and transmit them to the Plant Engineer.

e) Verify the continuity and arrangement of all "field side" wiring.

g) Provide input for the preparation and updating of the project schedule.

h) Perform all testing associated with the new inverters.

2.3.3 CYAPCO Instrumentation and Controls

a) Review and comment on the project installation specifications.

b) Perform all internal wiring modifications and circuit card rearrangements in the instrumentation cabinets.

c) Terminate cabling at all transmitters and containment penetrations.

d) Verify the continuity and arrangement of all "cabinet side" wiring.

e) Review and comment on preoperational testing procedures.

f) Perform all I&C preoperational testing procedures.

g) Support the integrated operability testing.

h) Prepare as-built drawings and transmit them to the Plant Engineer.

i) Provide input for the preparation and updating of the project schedule.

j) Generate reports for new stockcoded spare parts and advise stores of obsolete spare parts.

2.3.4 CYAPCO Operations

a) Review and comment on the detailed design.

b) Revise and review the affected operations procedures.

c) Support preoperational and integrated testing.

2.4 Nuclear Training

2.4.1 NUSCO Operator Training

a) Modify initial and requalification training programs to incorporate project design changes.

b) Provide classroom and/or hands-on training for the plant operators.

2.4.2 NUSCO Technical Training

a) Prepare training programs for the operation and testing of added plant equipment.

b) Provide classroom and/or hands-on training for the plant engineers and technicians.

2.4.3 NUSCO Simulator Technical Support

a) Update the simulator to incorporate applicable portions of this design change.

2.5 Project Management and Administrative Support

2.5.1 NUSCO Project Coordinator

a) Prepare and issue PERC packages.

b) Review equipment and construction bids.

c) Resolve conflicts between various projects and organizations.

d) Provide a project plan to ensure coordination of resources.

2.5.2 NUSCO Cost Engineering and Scheduling (PSD)

a) Prepare and revise project material and labor cost estimates.

b) Monitor, evaluate and report on cost variances.

c) Prepare and revise project engineering, design, and installation schedules.

d) Provide input to and coordination of the outage schedule.

e) Monitor, evaluate, and report on scheduling variances and critical path items.

2.5.3 NUSCO Purchasing

a) Prepare and issue Purchase Orders for materials and labor.

b) Provide expediting of materials as required.

c) Report the expected delivery dates of equipment if other than the "Date Required" on the Purchase Requisitions.

2.5.4 NUSCO Production Materials Group

a) Provide expediting of material as required.

3.0 CONDITIONS AND LIMITATIONS

This project shall be installed, tested, and declared operational prior to the completion of the 1993 CY Refueling Outage. This project shall request the performance of pre-outage work, to the extent allowable by CYAPCO Engineering and Operations, to ensure that the plant modification is completed within the planned duration of the outage. Precautions shall be taken during the equipment replacement's to

ensure that minimum channel operability requirements are adhered to. The Plant Operations sign-off on the AWO's will control these requirements.

4.0 REGULATORY REQUIREMENTS

This plant design change shall be performed in accordance with 10 CFR 50.59, however, an Unreviewed Safety Question may be involved based on the NRC's interpretations of the rule with regard to safety-related analog-to-digital conversions.

The following ISAP Topics are associated with the change:

ISAP Topic No. 1.21 - Regulatory Guide 1.97 Instrumentation
ISAP Topic No. 1.30 - Reactor Protection System Isolation
ISAP Topic No. 1.54 - Safety Implications of Control Systems
ISAP Topic No. 1.101 - Steam Generator Overfill Protection
ISAP Topic No. 2.04 - Modernize Reactor Protection and Control Systems

5.0 DESIGN

5.1 Bases of Current Design

5.1.1 Feedwater Control System

The Feedwater System is designed to:

1) Provide sufficient flow (approximately 7,600,000 lbs/hr) to the steam generators to extract heat from the reactor coolant and generate steam for power generation.

2) Perform the system safety function of containment isolation under accident conditions.

3) Be capable of isolating components, subsystems, or piping if required so that the system safety function will be maintained.

4) Provide for functional testing of the system and components to ensure structural integrity and leak tightness, operability and performance of active components, and capability of the integrated system to function as intended during normal, shutdown, and accident conditions.

5) Periodically test the operability of the isolation valves and associated apparatus.

The feedwater flow to the steam generator is controlled using steam flow as a demand signal for feedwater flow. A trimming action is achieved by measuring steam generator level and by modifying the level signal with a level controller. The level signal adds or subtracts from the feedwater flow signal to produce adjustments in the feedwater flow and to maintain proper steam generator level.

Note: The following design description describes the operation of the Feedwater Control System for Reactor Coolant Loop 1. The operation of Loops 2, 3, and 4 is similar.

Steam Flow

The primary flow element for the measurement of steam flow is the Dall flow tube (FE-1201-1). This compact flow section provides the lowest possible head loss in flow measurements where a high differential must be developed.

The differential pressure developed at the flow section for steam flow of zero pounds per hour and 2,500,000 pounds per hour are 0" W.C. to 574" W.C., respectively.

A Hagan Ring Balance flow and pressure indicating and integrating transmitter (FT-1201-1), provided with a three-valve manifold, measures steam flow as a function of differential pressure across the Dall flow tube (FE-1201-1). This transmitter also receives a direct steam pressure signal for flow compensation.

The transmitter (FT-1201-1) performs five essential functions: 1) It extracts the square root of the differential pressure signal to yield a signal linear with flow rate; 2) this linear flow signal is indicated; 3) this linear flow signal is multiplied by a correction factor that is a function of steam pressure, correcting steam flow for density changes caused by pressure variations; 4) the pressure compensated linearized flow is indicated; 5) the steam pressure is indicated. The +1 VDC to +9 VDC output of the transmitter (FT-1201-1) corresponds to a true steam flow of 0 pounds per hour to 2,500,000 pounds per hour for 0" W.C. to 574" W.C.

The pressure-compensated linearized output signal is transmitted: 1) to the feedwater flow controller; 2) to one pen of the Taylor steam and feedwater flow recorder FR-1201-1/1301-1); and 3) to a voltage sensitive relay.

The function of the feedwater controller will be reviewed later.

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The voltage sensitive relay is considered as part of the nuclear plant interlocks and is described in that section.

Feedwater Flow

The primary element for the measurement of feedwater flow is an orifice installed in a flow section (FE-1301-1) mounted in the feedwater line. The orifice develops a differential pressure of 0" W.C. to 530" W.C. for feedwater flow of 0 pounds per hour to 2,500,000 pounds per hour, respectively.

A Hagan Ring Balance flow indicating and integrating transmitter (FT-1301-1A), provided with a three-valve manifold, measures the feedwater flow as a function of differential pressure across the orifice (FE-1301-1). This transmitter performs three functions: 1) it extracts the square root of the differential pressure to linearize the feedwater flow signal; 2) it indicates the feedwater flow rate; and 3) it integrates the linearized feedwater flow signal. The linearized output signal of +1 VDC to +9 VDC corresponds to a flow range of 0 pounds per hour to 2,500,000 pounds per hour for a differential of 0" W.C. to 530" W.C., respectively.

The linearized output is transmitted to: 1) the feedwater flow controller; 2) the second pen of the Taylor steam and feedwater flow recorder (FR-1201-1/1301-1); and 3) a voltage sensitive relay.

The function of the feedwater controller will be reviewed later.

The voltage sensitive relay is considered as part of the nuclear plant interlocks and is described in that section.

Steam Generator Narrow-Range Level

The steam generator level is measured by a narrow range level transmitter (LT-1301-1) provided with a three valve manifold. A signal of 4 to 20 mA is converted to a signal of +1 VDC to +9 VDC. This signal of +1 VDC to +9 VDC represents 0% to 100% of level, respectively. These values correspond to differentials of 85" W.C. and 0" W.C., respectively, at 675 psig (501.4°F).

The output signal is tranrmitted to: 1) the input filter built into the steam generator level controller; 2) the Taylor narrow range level recorder (LR-1301-1); and 3) a voltage sensitive relay (LA-1301-1).

The input filter is a passive network designed to minimize transient noise in the signal to the level controller. The filter unit is packaged in the level controller. The time constant for the filter is continuously adjustable.

The Taylor narrow range level recorder (LR-1301-1) is mounted on the Main Control Board. The scale range for a +1 VDC to a +9 VDC is 0 to 100%, which represents 85" W.C. and 0" W.C., respectively.

The voltage sensitive relay (LA-1301-1) is considered part of the nuclear plant interlocks and is described in that section.

The filtered measured level signal is compared in the steam generator level controller with the

level setpoint signal originating at the setpoint potentiometer of the feedwater manual control station. The feedwater manual control station is mounted on the main control board.

The steam generator level controller is an adjustable proportional plus reset controller. In the steady state condition, the measured level is equal to the level setpoint and the output of the level controller will be a nominal -5 VDC. Any variation in measured level, either above or below the setpoint, will cause the output of the controller to increase or decrease. An increase in level will result in the feedwater control valve re-positioning toward the closed position to reduce the feedwater flow. A decrease in the level has the opposite effect.

Feedwater Flow Controller and Manual Flow Control Station

The feedwater flow controller compares the steam flow signal with the combined feedwater flow and level signal. The steam flow signal acts as the setpoint for feedwater flow. Any error between the steam flow signal and the combined feedwater flow and level signal will cause the flow controller to generate a proportional plus reset output signal to open or close the feedwater valve (FCV-1301-1) to correct the error between signals.

If the steam generator level signal is above the setpoint, the normal -5 VDC signal received from the steam generator level controller will increase. This will raise the combined feedwater flow and level signal, and if greater than the steam flow signal, will cause the feedwater valve (FCV-1301-1) to re-position toward the

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closed position. The feedwater demand signal is transmitted through the manual flow control station (FC-1301-1) to the Fisher electro-pneumatic (E/P) converter mounted at the Feedwater control valve (FCV-1301-1).

If the steam generator level is below the setpoint, the normal -5 VDC signal will decrease and the reverse of the above described action will occur.

The feedwater manual flow station (FC-1301-1) is a panel mounted controller which provides the operator with a remote manual means of regulating feedwater flow. When this station is set to "Automatic" (A), the signal from the feedwater flow controller is connected directly to the E/P converter. The manual flow control station output is indicated on the upper meter of the station. When the station is set to "Manual" (M), the signal from the feedwater flow controller is interrupted and a signal originating at the manual station is used to position the Feedwater Control Valve (FCV-1301-1).

Transfer from "Automatic" (A) to "Manual" (M) is accomplished by: 1) adjusting the manual potentiometer (MAN) to null the lower indicator of the manual flow control station and 2) transfer the manual/automatic (M/A) switch to manual (M).

Transfer from "Manual" to "Automatic" is accomplished by one of the following methods:

A. To retain the established steam generator level controller setpoint proceed as follows:

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1) adjust the manual potentiometer (MAN) to null the lower indicator of the manual flow control station; and
2) transfer the manual/automatic (M/A) switch to automatic (A).

B. To change the established steam generator level controller setpoint to provide the manually adjusted valve position as follows:

1) adjust the steam generator level controller setpoint on the manual station to bring the feedwater flow controller output signal into agreement with the manual station output. This is indicated by a null on the lower indicator of the manual station; and

2) transfer the manual/automatic (M/A) switch to automatic (A).

The above procedures for transferring from automatic to manual or the reverse assures that the transfer is made without a sudden change in feedwater control valve position.

The Fisher E/P converter converts the +1 VDC to +9 VDC electrical signal to a corresponding pneumatic output of 6 to 30 psig. The pneumatic signal is then used to position the feedwater control valve (FCV-1301-1). A decreasing signal will close the feedwater control valve, while an increasing signal will open the valve.

The air supply pressure for the control valve operation is reduced to 32 psig by a filter-regulator mounted on the control valve.

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Between the valve positioner and the valve diaphragm, three solenoids are provided. The solenoid valves provide automatic operation of the feed regulating valves following a turbine trip to:

1) Assist in the RCS cooldown.
2) Prevent over cooling of the RCS.
3) Prevent overfilling the S/G.

The solenoid valves are mounted on a panel located east of the feed regulating valves. Under normal conditions, solenoid valve SV-1 is energized, SV-2 is de-energized, and SV-3 is energized. This lineup allows the signal air from the positioner to pass directly to the valve.

After a turbine trip, the solenoid valves operate to position the feed regulating valve independently of the positioning signal from the three element controller. If the turbine trips and T_{avg} is above 545°F with the steam generator level below 69%, solenoid valves SV-1 and SV-3 will remain energized and SV-2 will energize causing a 30 psig air signal to replace the air signal coming from the positioner. This will cause the feed regulating valve to go to the full open position. When T_{avg} decreases to 545°F, SV-1 and SV-3 will de-energize. The feed regulating valve will fully close when the air vents off. SV-2 will be energized as long as steam generator level is less than 69%.

Nuclear Plant Interlocks

The following plant interlocks are provided by this system:

1) the voltage sensitive relay receives the pressure compensated linearized signal from the indicating flow and pressure transmitter (FT-1201-1) and the linearized signal from the indicating feedwater flow transmitter (FT-1301-1A). The relay is energized as long as the steam flow signal does not exceed the feedwater flow signal by 2.0 volts, corresponding to flow differential of 525,000 pounds per hour. In case a difference of 2.0 volts develops the relay is de-energized, providing the necessary alarm and safety actuation signals for excessive mismatch between steam and feedwater flow.

2) the voltage sensitive relay (LA-1301-1) receives a signal from the steam generator level controller and remains energized as long as the signal does not fall below a fixed value, indicating low level in the steam generator. When the relay is de-energized, the necessary alarm and safety actuation signals for steam generator low level are provided.

System Power Supply

The feedwater control system of each steam generator is supplied with regulated 115V, 60 cycle power from an individual bus.

The power supplies enter each rack at an AC distribution panel. Fusing of the distribution supply is provided at this panel. Indicating fuses are used throughout, except for these controllers containing their own indicating lights.

The patch board is the central distribution point for all other power and signal leads. Its functions are: 1) 115 VAC power is distributed to the controller and the power supplies; 2) +/-10 VDC power is distributed as required; and 3) signals from instruments or controllers are received and re-distributed as required.

Both primary and backup power supplies are provided so that a loss of a single bus does not result in a loss of automatic feedwater control or a reactor trip. The arrangement is as follows:

Steam Flow, Feed Flow, and Steam Generator Narrow-Range Level Transmitters

Loop	Primary Supply	Backup Supply
1	Vital A, Ckt. 3	Vital D, Ckt. 3
2	Vital B, Ckt. 3	Vital A, Ckt. 3
3	Vital C, Ckt. 3	Vital B, Ckt. 3
4	Vital D, Ckt. 3	Vital C, Ckt. 3

Steam Flow/Feed Flow Mismatch Voltage Sensitive Relays

Loop	Primary Supply	Backup Supply
1	Vital A, Ckt. 3	Vital D, Ckt. 3
2	Vital B, Ckt. 3	Vital A, Ckt. 3
3	Vital C, Ckt. 3	Vital B, Ckt. 3
4	Vital D, Ckt. 3	Vital C, Ckt. 3

Steam Flow/Feed Flow Mismatch Slave Relays

Relay	Primary Supply	Backup Supply
FM1	Vital D, Ckt. 3	Vital C, Ckt. 3

FM2	Vital C, Ckt. 3	Vital B, Ckt. 3
FM3	Vital B, Ckt. 3	Vital A, Ckt. 3
FM4	Vital A, Ckt. 3	Vital D, Ckt. 3

Steam Generator Narrow-Range Level Voltage Sensitive Relays

Loop	Primary Supply	Backup Supply
1	Vital A, Ckt. 3	Vital D, Ckt. 3
2	Vital B, Ckt. 3	Vital A, Ckt. 3
3	Vital C, Ckt. 3	Vital B, Ckt. 3
4	Vital D, Ckt. 3	Vital C, Ckt. 3

Steam Generator Narrow-range Level Slave Relays

Relay	Primary Supply	Backup Supply
SGL1	Vital A, Ckt. 3	Vital D, Ckt. 3
SGL2	Vital B, Ckt. 3	Vital A, Ckt. 3
SGL3	Vital C, Ckt. 3	Vital B, Ckt. 3
SGL4	Vital D, Ckt. 3	Vital C, Ckt. 3

Feedwater Control 10 VDC Power Supplies

Loop	Primary Supply	Backup Supply
1	Vital A, Ckt. 3	Vital D, Ckt. 3
2	Vital B, Ckt. 3	Vital A, Ckt. 3
3	Vital C, Ckt. 3	Vital B, Ckt. 3
4	Vital D, Ckt. 3	Vital C, Ckt. 3

Feed Regulating Valve Solenoids SV-1, SV-2, SV-3

All twelve powered from Semi-Vital Bus 2.

5.1.2 Steam Flow/Feedwater Flow Mismatch Reactor Trip

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A potential loss of heat sink due to loss of water inventory in the steam generator can be recognized in advance if steam flow rates exceed feedwater flow rates. To reduce the loss of steam generator inventory, a reactor trip is provided on coincident signals of large steam flow/feedwater flow mismatch and low steam generator water level for any one of the four steam generators.

This trip channel uses the flow signals for main steam and feedwater sensed by the steam generator level control system for each steam generator. The steam flow signal for each loop is compared to the feedwater flow signal for the same loop.

If steam flow exceeds feedwater flow by more than 20% of the mass flow rate for full power steam demand, an alarm will sound. If the steam generator level, as indicated by the narrow range level transmitter in the same loop, is 10% or below, an alarm will sound. Any of the four loops will produce a reactor trip if these two conditions simultaneously occur in a given loop.

5.1.3 Steam Line Break Reactor Trip

Excessive steam flow will cool the RCS and insert positive reactivity because the temperature coefficient is negative. For this reason a two-out-of-four logic is set up to trip the reactor on steam flow greater than 110% of full power steam flow. Steam flow in each of the four main steam lines is sensed as a pressure differential across elbow taps located in the first 90 degree elbow outside the reactor containment. This signal is sent to a meter relay bistable in the control room, where a trip signal is initiated

and all main steam trip valves close, if two channel setpoints are exceeded. A large steam line break upstream of these pressure taps will trip the reactor through either high flux or low pressure reactor trip.

A reactor trip will also occur if the lower limit switch on any of the main steam trip valves indicate closure of the valve. This trip is inactive below 10% (P7) power.

5.1.4 Steam Generator Overfill Protection

Each Steam Generator has two wide-range level transmitters (LT-1302-1A, -1B, -2A, -2B, -3A, -3B, -4A, -4B). Steam Generator overfill protection is initiated if either wide-range level transmitter senses a 69% high level condition. This one-out-of-two initiation logic will then isolate main feedwater by closing the main feedwater regulating valves.

5.1.5 Vital Inverters A and B

The Train A Channels A and B 120 V vital AC power system consists of two 3 kVA inverters—Inverter A and Inverter B. They are located in Switchgear Room A on the same rack with abandoned Inverters C and D which were replaced with new ones located in Switchgear Room B.

The 125 VDC input is supplied to the inverters from DC-BUS-A Circuits 8 and 20.

The 120 VAC regulated outputs of Inverters A and B are supplied to 120 VAC vital Buses A and B, respectively, in the main control board. The supply from the inverters can be aligned such that Inverter A can also supply Vital Bus B, and

Inverter B can also supply Vital Bus A. The cross-connect is performed manually and doing so places the plant in a technical specification action item (TS 3/4.3.8.3.1). Also, due to existing load constraints on Inverters A and B, some loads must be manually shed in order to utilize this alignment (per CY procedure AOP 3.2-15, "Loss of Vital Bus").

External cooling fans are installed underneath the inverters to supply cooling to interior components. The power source for this circuit is panel LP-C1-1A.

An annunciator on the main control board signifies loss of voltage on a vital bus.

5.2 Method of Change

5.2.1 Steam Generator Feedwater Flow Transmitter

a) Install a transmitter rack in the Turbine Building (El. 21'6") near the existing Steam Generator feedwater flow transmitter rack.

b) Install new instrument tubing to the new instrument rack.

c) Mount eight 4-20 mA, Class 1E Steam Generator feedwater flow transmitters, FT-1301-1B, -1C, -2B, -2C, -3B, -3D, -4B, and -4D on the new transmitter rack.

d) Connect the new tubing to FT-1301-1B and FT-1301-1C. Install independent valving to each transmitter.

e) Connect the new tubing to FT-1301-2B and FT-1301-2C. Install independent valving to each transmitter.

f) Connect the new tubing to FT-1301-3B and FT-1301-3D. Install independent valving to each transmitter.

g) Connect the new tubing to FT-1301-4B and FT-1301-4D. Install independent valving to each transmitter.

h) Install channel segregated raceway and cable from the new transmitters to the Main Control Room for Channels C and D. Use existing cable and raceway for Channel B.

i) Install Main Control Room circuitry, cable, and wire.

j) Perform continuity tests and terminate all cable and wire.

k) Energize, test, and calibrate the equipment.

l) Remove the old Steam Generator feedwater flow transmitters and associated hardware.

5.2.2 Steam Generator Steam Flow Transmitters

a) Install a transmitter rack in the Turbine Building (El. 37'6") near the existing Steam Generator steam flow transmitter rack.

b) Install new instrument tubing to the new instrument rack.

c) Mount eight 4-20 mA, Class 1E Steam Generator Steam flow transmitters, FT-1201-1B,

-1C, -2B, -2C, -3B, -3D, -4B, and -4D on the new transmitter rack.

d) Connect the new tubing to FT-1201-1B and FT-1201-1C. Install independent valving to each transmitter.

e) Connect the new tubing to FT-1201-2B and FT-1201-2C. Install independent valving to each transmitter.

f) Connect the new tubing to FT-1201-3B and FT-1201-3D. Install independent valving to each transmitter.

g) Connect the new tubing to FT-1201-4B and FT-1201-4D. Install independent valving to each transmitter.

h) Install channel segregated raceway and cable from the new transmitters to the Main Control Room for Channels C and D. Use existing cable and raceway for Channel B.

i) Install Main Control Room circuitry, cable, and wire.

j) Perform continuity tests and terminate all cable and wire.

k) Energize, test, and calibrate the equipment.

l) Remove the old Steam Generator steam flow transmitters and associated hardware.

5.2.3 Steam Generator Narrow-Range Level Transmitters

a) Seismically install two dual transmitter mounts near each existing Steam Generator

narrow-range level trans itter LT-1301-1, -2, -3, and -4 at the mi level of the Containment outer annulus.

b) Seismically extend the instrument tubing for LT-1301-1, -2, -3, and -4 to the two new transmitter mounts.

c) Seismically mount one 4-20 mA, Class 1E Steam Generator narrow-range level transmitter on one of the new dual transmitter mounts at each location. Install LT-1301-1A on Loop 1; LT-1301-2A on Loop 2; LT-1301-3A on Loop 3; and LT-1301-4A on Loop 4.

d) Seismically mount two 4-20 mA, Class 1E Steam Generator narrow-range level transmitters on the other dual transmitter mount. Install LT-1301-1C and LT-1301-1D on Loop 1; LT-1301-2C and LT-1301-2D on Loop 2; LT-1301-3C and LT-1301-3D on Loop 3; and LT-1301-4C and LT-1301-4D on Loop 4.

e) Connect the extended tubing from LT-1301-1 to LT-1301-1A, LT-1301-1C, and LT-1301-1D. Install independent valving to each transmitter.

f) Connect the extended tubing from LT-1301-2 to LT-1301-2A, LT-1301-2C, and LT-1301-2D. Install independent valving to each transmitter.

g) Connect the extended tubing from LT-1301-3 to LT-1301-3A, LT-1301-3C, and LT-1301-3D. Install independent valving to each transmitter.

h) Connect the extended tubing from LT-1301-4 to LT-1301-4A, LT-1301-4C, and LT-1301-4D. Install independent valving to each transmitter.

i) Seismically install channel-segregated conduit and cable from the new transmitters to the Containment penetrations.

j) Use spare cable from PA 83-117 from the Cable Vault to the Main Control Room.

k) Install Main Control Room circuitry, cable, and wire.

l) Perform continuity tests and terminate all cable and wire.

m) Energize, test, and calibrate the equipment.

n) Remove the old Steam Generator Narrow Range Level transmitters and associated hardware.

5.2.4 Steam Line Break Flow Transmitters

a) Seismically mount four 4-20 mA, Class 1E Steam Line flow transmitters in place of existing flow transmitters FT-1202-1, -2, -3, and -4 in the Protective Enclosures.

b) Seismically extend and connect existing tubing and independent valving to each transmitter.

c) Utilize existing field cabling.

d) Install Main Control Room circuitry, cable, and wire.

e) Perform continuity tests and terminate all cable and wire.

f) Energize, test, and calibrate equipment.

g) Remove the old Steam Line Break Flow transmitters and associated hardware.

5.2.5 Steam Generator Pressure Transmitters

a) Seismically mount four 4-20 mA, Class 1E Steam Generator pressure transmitters in place of existing containment mounted pressure transmitters PT 1201-1, -2, -3, and -4. Relable the new transmitters as PT 1201-1B, -2B, -3B, and -4B. Utilize the spare mounts beside the Train A Steam Generator narrow-range level transmitters.

b) Relable the existing Steam Generator pressure transmitters (PT 1201-1B, -2B, -3B, and -4B) mounted in the Terry Turbine Building as PT 1201-1C, -2C, -3D, and -4D.

c) Seismically extend and connect existing tubing and independent valving to each transmitter.

d) Utilize existing field cabling.

d) Install Main Control Room circuitry, cable, and wire.

e) Perform continuity tests and terminate all cable and wire.

f) Energize, test, and calibrate equipment.

g) Remove the old containment mounted Steam Generator pressure transmitters and associated hardware.

5.2.6 Main Control Room Instrumentation Cabinets

a) Seismically install the two new two-bay Feedwater Protection instrumentation cabinets behind the Main Control Board.

b) Remove the existing Hagan Feedwater Control System instrumentation cabinets in the rear of Main Control Board D-E.

c) Seismically install the two new single-bay Feedwater Control System instrumentation cabinets in the rear of Main Control Board D-E.

d) Connect wiring from existing Foxboro cabinets "NB" and "NS" for bypass flow input to Feedwater Control System utilizing existing spare cable.

e) Wire existing spare steam/feed flow mismatch logic-to-contact relays in Reactor Trip Logic cabinets to plant annunciator and computer.

f) Remove existing contact-to-logic cards for Steam Line Break inputs and add new logic-to-contact relays in Reactor Trip Logic cabinets to plant annunciator and computer.

g) Terminate all field cable and wire at the new Feedwater Control System instrumentation cabinets.

h) Energize, test, and calibrate the equipment.

5.2.7 Main Control Board Modifications

a) Remove obsolete Main Control Board equipment and move existing equipment as necessary.

b) Seismically mount replacement and additional Main Control Board equipment.

c) Install Main Control Board cable and wire

d) Perform continuity tests and terminate all cable and wire.

e) Energize, test, and calibrate the equipment.

5.2.8 Vital Inverters A and B

a) The new vital power supplies are specified to be as identical as possible to that of Inverters C and D. As such, the new arrangement will consist of two inverter cabinets and two constant voltage transformers which are used as an alternate source.

b) Existing Inverters A and B will be electrically disconnected. Existing field cables will be re-utilized to the best extent possible.

c) The external cooling fans will be deenergized and removed. The circuit will be disconnected at Panel LP-C1-1A. The new inverters have internally powered cooling fans.

d) Existing Inverters A and B, abandoned Inverters C and D, and their associated mounting rack will be physically removed. The new inverter cabinets and constant volt-

age transformers will be located in this area. The inverter cabinets will be floor mounted. The constant voltage transformers will be attached to a floor-mounted rack.

e) The DC input to the inverters will still be from DC-BUS-A. The existing circuit breakers will be used and the input cables will be re-utilized to the best extent practical.

f) Two new circuits will be required from MCC-13 to supply input to the alternate source constant voltage transformers.

g) New control cable and raceway will be added from the inverters to the main control board annunciator to signify inverter trouble.

5.3 Design Inputs

5.3.1 American National Standards Institute

a) ANSI N45.2, 1977 — Quality Assurance Program Requirements for Nuclear Power Plants

b) ANSI N45.2.2, 1972 — Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power plants

c) ANSI C39.1, 1981 — Requirements for Electrical Analog Indicating Instruments

d) ANSI C39.2, 1964 — Direct Acting Electrical Recording Instruments.

e) ANSI C39.5, 1974 — Safety Requirements for Electrical and Electronic Measuring and Controlling Instrumentation.

f) ANSI/IEEE-ANS-7.4.3.2, 1982 — Application Criteria for Programmable Digital Computer Systems and Safety Systems of Nuclear Power Generating Stations.

g) ANSI/IEEE 741-90 — Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations.

5.3.2 American Society for Testing and Materials

a) ASTM A262, 1986 — Recommended Practice for Detecting Susceptibility to Inter-granular Attack in Stainless Steels.

b) ASTM A380, 1978 — Recommended Practice for De-scaling and Cleaning Stainless Steel Surfaces.

5.3.3 Institute of Electrical and Electronic Engineers

a) IEEE 279, 1971 — Criteria for Protection Systems for Nuclear Power Generating Stations.

b) IEEE 308, 1980 — Criteria for Class 1E Power Systems for Nuclear Power Generating Stations.

c) IEEE 317, 1983 — Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations.

d) IEEE 323, 1974 — Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

e) IEEE 338, 1977 — Criteria for Periodic Testing of Nuclear Power Generating Station Safety Systems.

f) IEEE 344, 1975 — Trial Use Guide for Seismic Qualification of Class 1E Electrical Equipment for Nuclear Power Generating Stations.

g) IEEE 336, 1985 — Standard Installation, Inspection and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities.

h) IEEE 379, 1977 — Application of the Single Failure Criterion to Nuclear Power Generating Station Class 1E Systems.

i) IEEE 381, 1977 — Criteria for Type Tests of Class 1E Modules Used in

		Nuclear Power Generating Stations.
j)	IEEE 383, 1974	Standard for Type Test of Class 1E Electric Cables; Field Splices and Connections for Nuclear Power Generating Stations.
k)	IEEE 384, 1981	Criteria for Independence of Class 1E Equipment and Circuits.
l)	IEEE 420, 1982	Design and Qualification of Class 1E Control Boards, Panels and Racks used in Nuclear Power Generating Stations.
m)	IEEE 467, 1980	Quality Assurance Program Requirements for the Design and Manufacture of Class 1E Instrumentation and Electrical Equipment for Nuclear Power Generating Stations.
n)	IEEE 472, 1974	Guide for Surge Withstand Capability (SWC) Tests.
o)	IEEE 577, 1976	Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Power Generating Stations.
p)	IEEE 603, 1980	Criteria for Safety Systems for Nuclear Power Generating Stations.

q) IEEE 650, 1979 — Standard for Qualification of Class 1E Battery Chargers and Inverters for Nuclear Power Generating Stations.

r) IEEE 690, 1984 — Design and Installation of Cable Systems for Class 1E Circuits in Nuclear Power Generating Stations.

s) ANSI/IEEE-ANS-7-4.3.2-1982 — Applicati[illegible]riteria for Programma[illegible]igital Computer S[illegible]n Safety Systems of N[illegible]ear Power Generating Sta[illegible]ions.

5.3.4 U.S. Nuclear Regulatory Commission (NRC)

a) 10CFR50, Appendix B — Quality Assurance, Criteria for Nuclear Power Plants.

b) 10CFR, Part 21 — Reporting of Defects and Non-compliance.

c) 10CFR50, Appendix R — Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979.

d) 10CFR50.49 — Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants.

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NUCLEAR ENGINEERING & OPERATIONS
PROJECT DESCRIPTION

PROJECT TITLE

DRAFT

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MODERNIZE FEEDWATER CONTROL

PROJECT

e)	10CFR50.59	Changes, tests and experiments.
f)	R.G. 1.22	Periodic Testing of Protection System Actuation Functions.
g)	R.G. 1.29, Rev. 3 Sept. 1978	Seismic Design Classification.
h)	R.G. 1.38, Rev. 2 May 1977	Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants.
i)	R.G. 1.75, Rev. 2 Sept. 1978	Physical Independence of Electrical Systems.
j)	R.G. 1.89, Rev. 1 June 1984	Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants.
k)	R.G. 1.97, Rev. 3 Dec. 1980	U. S. Regulatory Commission Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environmental Conditions during and following an accident.
l)	R.G. 1.100, Rev. 1	Seismic Qualification

	Aug. 1977	of Electric Equipment for Nuclear Power Plants.
m)	R.G. 1.152 Nov. 1985	Criteria for Programmable Digital Computer System Software in Safety-Related Systems of Nuclear Power Plants.
n)	NUREG-0588, Rev. 1 July 1981	Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment.

5.3.5 Instrument Society of America

a)	ISA, S67.01, 1979	Transducer and Transmitter Installation for Nuclear Safety Applications.
b)	ISA, S67.06, 1984	Response Time Testing of Nuclear Safety-Related Instrument Channels in Nuclear Plants.

5.3.6 Mechanical Engineering Standards

a) ASME Boiler and Pressure Vessel Code, Section III and IX 1983 Edition up to and including Winter 1983 Addenda.

b) ASME Boiler and Pressure Vessel Code, Section XI, "Inservice Inspection." 1983 Edition up to and including the Summer 1984 Addenda.

c) AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings; 8th Edition.

d) AWS D1.3, Specification for Welding Sheet Steel and Structures (1981), of latest Edition in effect during installation.

e) AWS D1.1, Structural Welding Code (1984), or Latest Edition in effect during installation.

f) Welder Qualifications per AWS D1.1, AWS D1.3 and ASME Section IX as applicable.

Note: Latest issue of such specifications, standards, and codes means the issue (including latest published case ruling, interpretation, and addenda) in force on the date of the PDCR. Adoption of any subsequent issue of case rulings shall be subject to the owner's approval. Northeast Utilities Welding Manual referencing earlier additions to the code are acceptable. C. N. Flagg Welding Manuals referencing earlier additions to the code are acceptable.

5.3.7 Plant Design Documents/Inputs

a) CYAPCO Haddam Neck Station Updated FSAR (May, 1987).

b) NUSCO Nuclear Training Manuals for Connecticut Yankee Systems.

c) Connecticut Yankee System Descriptions, Revision 1.

d) Feedwater Control System Description A-4079, Westinghouse Electric Corporation.

e) Reactor Control and Protection System Description CYW-300, Westinghouse Electric Corporation.

5.4 Detailed Design

5.4.1 Procurement Specifications

a) NUSCO Specification SP-EE-323 establishes the requirements for instrumentation to replace the Feedwater Control System and secondary-side Reactor Protection functions. This instrumentation was purchased QA Category 1, Class 1E from the Foxboro Company under Purchase Order 884365. (Portions of the Purchase Order are non-QA.)

b) Field transmitters were purchased QA Category 1, Class 1E, from Rosemount Incorporated under Purchase Order 235030.

c) Main Control Board indicators were purchased QA Category 1, Class 1E from International Instruments under Purchase Order 886451.

d) NUSCO Specification SP-EE-336 establishes the requirements for the Vital Inverters and associated hardware. This equipment was purchased QA Category 1, Class 1E from Cyberex Incorporated under Purchase Order 887440.

e) All new cable to be installed has been purchased QA Category 1 and satisfies the flame retardant requirements of IEEE 383.

5.4.2 Design Drawings

a) A functional description of this plant design change is provided by drawings listed on drawing index, 16103-31095, Sheets 1B, 1C, and 1D.

b) Connection diagrams of all Foxboro internal cabinet wiring are provided by drawings listed on drawing index, 16103-31095, Sheets 1B, 1C, and 1D.

c) The following loop connection diagrams show the overall instrument channel arrangements and physical layout, including field interconnections:

16103-31079, Sh. 37A	SG #1 Level & Pressure
16103-31079, Sh. 37B	SG #1 Steam/Feed Flow & SLB
16103-31079, Sh. 38A	SG #2 Level & Pressure
16103-31079, Sh. 38B	SG #2 Steam/Feed Flow & SLB
16103-31079, Sh. 39A	SG #3 Level & Pressure
16103-31079, Sh. 39B	SG #3 Steam/Feed Flow & SLB
16103-31079, Sh. 40A	SG #4 Level & Pressure
16103-31079, Sh. 40B	SG #4 Steam/Feed Flow & SLB
16103-31079, Sh. 58	SG #1-4 WR Level Ch. A
16103-31079, Sh. 59	SG #1-4 WR Level Ch. B
16103-31079, Sh. 66	SG Pressure Ch. C & D
16103-32150, Sh. 11B	Auxiliary Feedwater Flow

d) The seismic design and mounting details of equipment installed under this plant design change is detailed by the following approved design drawings:

16103-28803, Sh. 12A	Transmitter Racks Turbine Building
16103-28803, Sh. 12B	Transmitter Support Containment
16103-33035, Sh. 25A	Spec. 200 Cabinet Installation

e) Instrument tubing and valving associated with this plant design change are detailed by the following approved design drawings:

16103-28807, Sh. 1	ISO-Steam Flow Transmitters FT-1201-1B, 1C, 2B, 2C
16103-28807, Sh. 2	ISO-Steam Flow Transmitters FT-1201-3B, 3D, 4B, 4D
16103-28808, Sh. 1	ISO-Feedwater Flow Transmitters FT-1301-1B, 1C, 2B, 2C
16103-28808, Sh. 2	ISO-Feedwater Flow Transmitters FT-1301-3B, 3D, 4B, 4D
16103-28059, Sh. 9A	ISO-SG #1 Transmitter LT-1301-1A, 1C, 1D
16103-28059, Sh. 10A	ISO-SG #2 Transmitter LT-1301-2A, 2C, 2D
16103-28059, Sh. 11A	ISO-SG #3 Transmitter LT-1301-3A, 3C, 3D
16103-28059, Sh. 12A	ISO-SG #4 Transmitter LT-1301-4A, 4C, 4D

f) Modifications to the Main Control Board equipment layout are detailed by the following approved design drawings:

16103-30049, Sh. 5	MCB Front View, Panel E
16103-30049, Sh. 6	MCB Front View, Panel F (Front-Top)

16103-30049, Sh. 6A	MCB Front View, Panel F (Bottom)
16103-30049, Sh. 7	MCB Front View, Panel G (Top)
16103-30049, Sh. 13	MCB Relay Panels D10 and D11 (Rear)
16103-30049, Sh. 13A	MCB Relay Panels D10 and D11 (Rear)
16103-30049, Sh. 14	MCB Relay Panels F7 and F8 (Rear)
16103-30058, Sh. 2	MCB Front View Post-Accident Panel FF

g) The following drawing transmittals incorporate this plant design change:

PSD-DT-630-92	PSD-DT-637-92	PSD-DT-826-92
PSD-DT-631-92	PSD-DT-742-92	
PSD-DT-632-92	PSD-DT-765-92	
PSD-DT-633-92	PSD-DT-769-92	
PSD-DT-634-92	PSD-DT-785-92	
PSD-DT-635-92	PSD-DT-805-92	

5.4.3 Design Evaluations

a) NUSCO ENGINEERING MECHANICS, in conjunction with NUSCO CIVIL DESIGN, will perform a Seismic Qualification review and design verification to examine the seismic integrity of equipment and equipment mounting configurations.

b) NUSCO ELECTRICAL ENGINEERING (PSD) will perform a review and design verification to examine the impact of the change on existing electrical equipment and the electrical characteristics of the added equipment used to implement the plant design change.

c) NUSCO ELECTRICAL ENGINEERING, SPECIAL STUDIES, will perform a review and design verification to examine the Environmental Qualification of equipment purchased to implement the plant design change as well as the installation of this equipment in harsh environments.

d) NUSCO I&C ENGINEERING will perform a review and design verification of the overall change and the impact of the change on existing instrumentation and control equipment.

e) NUSCO PROBABILISTIC RISK ASSESSMENT has performed a review and design verification concluding that the plant design change will result in a net reduction in core melt frequency.

f) NUSCO RELIABILITY ENGINEERING has performed a reliability analysis for this plant design change in accordance with IEEE 577-1976, Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Power Generating Stations.

5.4.4 Conformance to IEEE 279-1971 and IEEE 603-1980

5.4.4.1 Single-Failure Criteria

This portion of the instrumentation upgrade will perform all safety functions required for a design basis event in the presence of: (1) any single detectable failure within the safety systems concurrent with all identifiable but nondetectable failures; (2) all, failures caused by the single failure;

and (3) all failures and spurious system actions which cause or are caused by the design basis event requiring the safety function.

This plant design change will enhance the adherence to the single failure criteria by:

a) Increasing channel and train independence and redundancy.

b) Providing a design and test scheme to eliminate identified nondetectable failures.

c) Reducing potential cascaded and design basis event failures.

d) Eliminating certain common mode failures through the use of qualified Class 1E components.

Specific safety implications are identified and addressed in the safety evaluations.

5.4.4.2 Completion of Protection Action

The Reactor Trip Logic Cabinets are designed so that, once initiated automatically or manually, the intended sequence of protective actions of the execute features will continue until completion.

5.4.4.3 Quality

Components and modules used in this plant design change are of a quality that is consistent with minimum maintenance requirements and low failure rates. The following failure rate information is applicable to this design:

Rosemount Transmitters	MTBF = 119 years
SPEC 200 Micro Card 2CCA-S	MTBF = 5.84 years
SPEC 200 Micro Card 2CCA-D	MTBF = 4.84 years
SPEC 200 Analog Modules	MTBF = 30 years

Note: Since the SPEC 200 Micro Cards are relatively new in comparison to other equipment, published MTBF figures are lower biased since less historical data is available.

5.4.4.4 Equipment Qualification

Safety system equipment used in this plant design change is Class 1E qualified in accordance with IEEE Std. 323-1974.

5.4.4.5 System Integrity

The safety system equipment used in this plant design change is designed to accomplish its safety function under the full range of applicable conditions enumerated in the design basis.

5.4.4.6 Independence

Physical separation and electrical isolation is provided in this plant design change to maintain the independence of Class 1E circuits and equipment.

Physical separation of redundant trains and channels of instrumentation is provided as follows:

- Containment protection instrumentation cabling is separated by channel segregated conduit.

- Protection instrumentation cabling through containment penetration are separated by distance between channel segregated penetration groups.

- Cable vault protection instrumentation cabling is separated by channel segregated conduit and cable tray.

- Protection Instrumentation cabling from the cable vault to the Control Room is through a common duct bank and cable tray. This is remanent of the original plant design in which separation requirements were not applicable. Cabling to protection instrumentation required for safe shutdown during fire scenarios is, however, separated as a result of PA 83-117 modifications.

- Main Control Board cabling and wiring is not train or channel separated.

- Cabling from the Main Control Board to the existing Foxboro racks is channel and train separated through the use of enclosed split wireway. Channel 1 instrumentation cable is routed in one half of the Channel 1 wireway while Channel 1 power cabling and associated control cabling is routed in the other half. This arrangement represents Channel's 2, 3, and 4, as well. Train A (Channel's 1 and 2) is physically separated from Train B (Channel's 3 and 4).

- Cabling from the Main Control Board to the new Foxboro protection racks is channel and train separated through the use of separate conduit.

- Cabling from the new and existing Foxboro protection racks to the Reactor Protection Logic Cabinets is train and channel segregated using conduit and enclosed split wireways. The Train A split wireway houses Channels 1 and 2, while the Train B split wireway houses Channels 3 and 4. Non-Class 1E annunciation and computer point cabling is housed in separate conduit and enclosed split wireway.

- Physical separation of redundant Foxboro protection racks is provided by distance and physical barriers.

Electrical isolation between safety and nonsafety circuitry is provided by qualified Class 1E analog and digital isolation devices. Isolation device application, in control and instrumentation circuits, is in accordance with IEEE Std. 384-1981, Figure 1.

5.4.4.7 Capability for Test and Calibration

Capability for testing and calibration of safety systems equipment will be provided while retaining the capability of the safety systems to accomplish their safety functions during power operation. This testing and calibration will duplicate, as closely as practicable, performance of the safety function.

This modification allows test signal injection of an appropriate magnitude to verify reactor trip setpoints of each redundant portion of the safety system and Reactor Trip Logic verification through the generation of "half" Reactor Trips. Verification of Reactor Trip coincidence logic is also available.

5.4.4.8 Information Displays

Display information will be provided for manually controlled actions for which no automatic control is provided. Display information will provide accurate, complete, and timely information pertinent to safety system status. Indication of bypass conditions will be

provided in the Control Room. Information displays provided for manually controlled protective actions will be visible from the location of the controls used to effect the actions.

5.4.5 Transmitters

This plant design change will replace/add the following Category 1, Class 1E transmitters:

TRANSMITTER	DESCRIPTION	RANGE
PT-1201-1B	SG #1 PRESSURE CHANNEL B	0 to 1200 PSIG
PT-1201-2B	SG #2 PRESSURE CHANNEL B	0 to 1200 PSIG
PT-1201-3B	SG #3 PRESSURE CHANNEL B	0 to 1200 PSIG
PT-1201-4B	SG #4 PRESSURE CHANNEL B	0 to 1200 PSIG
FT-1202-1	SG #1 STEAM LINE BREAK FLOW	-27 to 270 in. H_2O
FT-1202-2	SG #2 STEAM LINE BREAK FLOW	-27 to 270 in. H_2O
FT-1202-3	SG #3 STEAM LINE BREAK FLOW	-27 to 270 in. H_2O
FT-1202-4	SG #4 STEAM LINE BREAK FLOW	-27 to 270 in. H_2O
FT-1301-1B	SG #1 FEED FLOW CHANNEL B	0 to 528.74 in. H_2O
FT-1301-2B	SG #2 FEED FLOW CHANNEL B	0 to 531.22 in. H_2O
FT-1301-3B	SG #3 FEED FLOW CHANNEL B	0 to 533.56 in. H_2O
FT-1301-4B	SG #4 FEED FLOW CHANNEL B	0 to 529.51 in. H_2O
FT-1301-1C	SG #1 FEED FLOW CHANNEL C	0 to 528.74 in. H_2O
FT-1301-2C	SG #2 FEED FLOW CHANNEL C	0 to 531.22 in. H_2O
FT-1301-3D	SG #3 FEED FLOW CHANNEL D	0 to 533.56 in. H_2O
FT-1301-4D	SG #4 FEED FLOW CHANNEL D	0 to 529.51 in. H_2O
FT-1201-1B	SG #1 STEAM FLOW CHANNEL B	0 to 573.65 in. H_2O
FT-1201-2B	SG #2 STEAM FLOW CHANNEL B	0 to 573.65 in. H_2O
FT-1201-3B	SG #3 STEAM FLOW CHANNEL B	0 to 573.65 in. H_2O
FT-1201-4B	SG #4 STEAM FLOW CHANNEL B	0 to 573.65 in. H_2O
FT-1201-1C	SG #1 STEAM FLOW CHANNEL C	0 to 573.65 in. H_2O
FT-1201-2C	SG #2 STEAM FLOW CHANNEL C	0 to 573.65 in. H_2O
FT-1201-3D	SG #3 STEAM FLOW CHANNEL D	0 to 573.65 in. H_2O
FT-1201-4D	SG #4 STEAM FLOW CHANNEL D	0 to 573.65 in. H_2O
LT-1301-1A	SG #1 NARROW RANGE LEVEL CHANNEL A	82.3 to 17.6 in. H_2O
LT-1301-2A	SG #2 NARROW RANGE LEVEL CHANNEL A	82.3 to 17.6 in. H_2O
LT-1301-3A	SG #3 NARROW RANGE LEVEL CHANNEL A	82.3 to 17.6 in. H_2O
LT-1301-4A	SG #4 NARROW RANGE LEVEL CHANNEL A	82.3 to 17.6 in. H_2O

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LT-1301-1C	SG #1 NARROW RANGE LEVEL CHANNEL C	82.3 to 17.6 in. H_2O
LT-1301-2C	SG #2 NARROW RANGE LEVEL CHANNEL C	82.3 to 17.6 in. H_2O
LT-1301-3C	SG #3 NARROW RANGE LEVEL CHANNEL C	82.3 to 17.6 in. H_2O
LT-1301-4C	SG #4 NARROW RANGE LEVEL CHANNEL C	82.3 to 17.6 in. H_2O
LT-1301-1D	SG #1 NARROW RANGE LEVEL CHANNEL D	82.3 to 17.6 in. H_2O
LT-1301-2D	SG #2 NARROW RANGE LEVEL CHANNEL D	82.3 to 17.6 in. H_2O
LT-1301-3D	SG #3 NARROW RANGE LEVEL CHANNEL D	82.3 to 17.6 in. H_2O
LT-1301-4D	SG #4 NARROW RANGE LEVEL CHANNEL D	82.3 to 17.6 in. H_2O

5.4.6 Indicators

This plant design change will replace/add the following Category 1, Class 1E indicators:

INDICATOR	DESCRIPTION	RANGE
FI-1301-1B/FI-1301-1C	SG #1 FEED FLOW CHANNEL B & C	0 to 2.5PPH X 10^6
FI-1301-2B/FI-1301-2C	SG #2 FEED FLOW CHANNEL B & C	0 to 2.5PPH X 10^6
FI-1301-3B/FI-1301-3D	SG #3 FEED FLOW CHANNEL B & D	0 to 2.5PPH X 10^6
FI-1301-4B/FI-1301-4D	SG #4 FEED FLOW CHANNEL B & D	0 to 2.5PPH X 10^6
FI-1201-1B/FI-1201-1C	SG #1 STEAM FLOW CHANNEL B & C	0 to 2.5PPH X 10^6
FI-1201-2B/FI-1201-2C	SG #2 STEAM FLOW CHANNEL B & C	0 to 2.5PPH X 10^6
FI-1201-3B/FI-1201-3D	SG #3 STEAM FLOW CHANNEL B & D	0 to 2.5PPH X 10^6
FI-1201-4B/FI-1201-4D	SG #4 STEAM FLOW CHANNEL B & D	0 to 2.5PPH X 10^6
LI-1301-1A	SG #1 NARROW RANGE LEVEL CHANNEL A	0 to 100%
LI-1301-2A	SG #2 NARROW RANGE LEVEL CHANNEL A	0 to 100%
LI-1301-3A	SG #3 NARROW RANGE LEVEL CHANNEL A	0 to 100%
LI-1301-4A	SG #4 NARROW RANGE LEVEL CHANNEL A	0 to 100%
LI-1301-1C	SG #1 NARROW RANGE LEVEL CHANNEL C	0 to 100%
LI-1301-2C	SG #2 NARROW RANGE LEVEL CHANNEL C	0 to 100%
LI-1301-3C	SG #3 NARROW RANGE LEVEL CHANNEL C	0 to 100%
LI-1301-4C	SG #4 NARROW RANGE LEVEL CHANNEL C	0 to 100%
LI-1301-1D	SG #1 NARROW RANGE LEVEL CHANNEL D	0 to 100%
LI-1301-2D	SG #2 NARROW RANGE LEVEL CHANNEL D	0 to 100%
LI-1301-3D	SG #3 NARROW RANGE LEVEL CHANNEL D	0 to 100%
LI-1301-4D	SG #4 NARROW RANGE LEVEL CHANNEL D	0 to 100%
PI-1201-1B/PI-1201-1C	SG #1 PRESSURE CHANNEL B & C	0 to 1200 PSIG
PI-1201-2B/PI-1201-2C	SG #2 PRESSURE CHANNEL B & C	0 to 1200 PSIG
PI-1201-3B/PI-1201-3D	SG #3 PRESSURE CHANNEL B & D	0 to 1200 PSIG
PI-1201-4B/PI-1201-4D	SG #4 PRESSURE CHANNEL B & D	0 to 1200 PSIG
FI-1202-1	SG #1 STEAM LINE BREAK FLOW	0 to 150%
FI-1202-2	SG #2 STEAM LINE BREAK FLOW	0 to 150%

FI-1202-3	SG #3 STEAM LINE BREAK FLOW	0 to 150%
FI-1202-4	SG #4 STEAM LINE BREAK FLOW	0 to 150%
LI-1302-1A/LI-1302-1B	SG #1 WIDE RANGE LEVEL CHANNEL B & C	0 to 100%
LI-1302-2A/LI-1302-2B	SG #2 WIDE RANGE LEVEL CHANNEL B & C	0 to 100%
LI-1302-3A/LI-1302-3B	SG #3 WIDE RANGE LEVEL CHANNEL B & C	0 to 100%
LI-1302-4A/LI-1302-4B	SG #4 WIDE RANGE LEVEL CHANNEL B & C	0 to 100%
FI-1301-1	SG #1 AUXILIARY FEED FLOW	0 to 600 GPM
FI-1301-2	SG #1 AUXILIARY FEED FLOW	0 to 600 GPM
FI-1301-3	SG #1 AUXILIARY FEED FLOW	0 to 600 GPM
FI-1301-4	SG #1 AUXILIARY FEED FLOW	0 to 600 GPM

5.4.7 Recorders

This plant design change will replace/add the following non-safety-related recorders:

RECORDER	DESCRIPTION	RANGE
FR-1201-1/FR-1301-1	SG #1 STEAM/FEED FLOW	0 to 2.5PPH X 10^6
FR-1201-2/FR-1301-2	SG #2 STEAM/FEED FLOW	0 to 2.5PPH X 10^6
FR-1201-3/FR-1301-3	SG #3 STEAM/FEED FLOW	0 to 2.5PPH X 10^6
FR-1201-4/FR-1301-4	SG #4 STEAM/FEED FLOW	0 to 2.5PPH X 10^6
LR-1301-1	SG #1 NARROW RANGE LEVEL	0 to 100%
LR-1301-2	SG #2 NARROW RANGE LEVEL	0 to 100%
LR-1301-3	SG #3 NARROW RANGE LEVEL	0 to 100%
LR-1301-4	SG #4 NARROW RANGE LEVEL	0 to 100%

Note: These recorders may not be utilized to provide future Regulatory Guide 1.97 indication (Type A) as they are not qualified. Qualified units were proposed to meet potential future needs, however, plant operators preferred the design caractaristics of the above nonqualified units.

5.4.8 Auto/Manual Stations

This plant design change will replace/add the following non-safety-related A/M Stations:

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PROJECT

STATION	DESCRIPTION
FC-1301-1	SG #1 Main Feed Regulating Valve
FC-1301-2	SG #2 Main Feed Regulating Valve
FC-1301-3	SG #3 Main Feed Regulating Valve
FC-1301-4	SG #4 Main Feed Regulating Valve
HC-1201-1	SG #1 Auxiliary Feed Regulating Valve
HC-1201-2	SG #2 Auxiliary Feed Regulating Valve
HC-1201-3	SG #3 Auxiliary Feed Regulating Valve
HC-1201-4	SG #4 Auxiliary Feed Regulating Valve

5.4.9 Annunciators

Existing Main Control Board annunciators will be maintained, however, certain rearrangement is necessary. Bistable inputs will be provided by the new equipment. In addition, the following Main Control Board Annunciators will be added or changed:

WINDOW	DESCRIPTION
E111U/E111L	SG #1 STEAM FLOW/FEED FLOW DEVIATION
E112U/E112L	SG #2 STEAM FLOW/FEED FLOW DEVIATION
E113U/E113L	SG #3 STEAM FLOW/FEED FLOW DEVIATION
E114U/E114L	SG #4 STEAM FLOW/FEED FLOW DEVIATION
E121U/E121L	SG #1 LEVEL DEVIATION/HIGH LEVEL
E122U/E122L	SG #2 LEVEL DEVIATION/HIGH LEVEL
E123U/E123L	SG #3 LEVEL DEVIATION/HIGH LEVEL
E124U/E124L	SG #4 LEVEL DEVIATION/HIGH LEVEL
F218U/F218L	SG #1 OVERFILL PROTECTION ACTUATED/LO-LO LEVEL
F219U/F219L	SG #2 OVERFILL PROTECTION ACTUATED/LO-LO LEVEL
F220U/F220L	SG #3 OVERFILL PROTECTION ACTUATED/LO-LO LEVEL
F221U/F221L	SG #4 OVERFILL PROTECTION ACTUATED/LO-LO LEVEL
F237	FWCS CARD FAILURE
G128	A/B VITAL AC TROUBLE

Also, the following Main Control Board Annunciators will be deleted:

E117	STEAM LINE BREAK SIGNAL LOW
E119	SG LEVEL TRANSMITTER SIGNAL HI
F237	FEEDWATER 10 VDC FAILURE
G128	VITAL BUS INVERTER OFF

5.4.10 Computer Points

Existing analog and digital computer points will be maintained. Bistable and signal inputs will be provided by the new equipment. In addition, the following computer points will be added:

ANALOG

SG #1 NARROW RANGE LEVEL CHANNEL A	0-100%	0-10.24V
SG #1 NARROW RANGE LEVEL CHANNEL C	0-100%	0-10.24V
SG #1 NARROW RANGE LEVEL CHANNEL D	0-100%	0-10.24V
SG #2 NARROW RANGE LEVEL CHANNEL A	0-100%	0-10.24V
SG #2 NARROW RANGE LEVEL CHANNEL C	0-100%	0-10.24V
SG #2 NARROW RANGE LEVEL CHANNEL D	0-100%	0-10.24V
SG #3 NARROW RANGE LEVEL CHANNEL A	0-100%	0-10.24V
SG #3 NARROW RANGE LEVEL CHANNEL C	0-100%	0-10.24V
SG #3 NARROW RANGE LEVEL CHANNEL D	0-100%	0-10.24V
SG #4 NARROW RANGE LEVEL CHANNEL A	0-100%	0-10.24V
SG #4 NARROW RANGE LEVEL CHANNEL C	0-100%	0-10.24V
SG #4 NARROW RANGE LEVEL CHANNEL D	0-100%	0-10.24V
SG #1 FEEDWATER FLOW CHANNEL C	0-2.5PPH X 10^6	0-80mV
SG #2 FEEDWATER FLOW CHANNEL C	0-2.5PPH X 10^6	0-80mV
SG #3 FEEDWATER FLOW CHANNEL D	0-2.5PPH X 10^6	0-80mV
SG #4 FEEDWATER FLOW CHANNEL D	0-2.5PPH X 10^6	0-80mV
SG #1 STEAM FLOW CHANNEL B	0-2.5PPH X 10^6	0-80mV
SG #2 STEAM FLOW CHANNEL B	0-2.5PPH X 10^6	0-80mV
SG #3 STEAM FLOW CHANNEL B	0-2.5PPH X 10^6	0-80mV
SG #4 STEAM FLOW CHANNEL B	0-2.5PPH X 10^6	0-80mV
SG #1 STEAM FLOW CHANNEL C	0-2.5PPH X 10^6	0-80mV
SG #2 STEAM FLOW CHANNEL C	0-2.5PPH X 10^6	0-80mV

SG #3 STEAM FLOW CHANNEL D	0-2.5PPH X 10^6	0-80mV
SG #4 STEAM FLOW CHANNEL D	0-2.5PPH X 10^6	0-80mV
SG #1 PRESSURE CHANNEL B	0-1200 PSIG	0-1.24V
SG #2 PRESSURE CHANNEL B	0-1200 PSIG	0-1.24V
SG #3 PRESSURE CHANNEL B	0-1200 PSIG	0-1.24V
SG #4 PRESSURE CHANNEL B	0-1200 PSIG	0-1.24V

DIGITAL

SG #1 NR LEVEL CHANNEL A HIGH/NORMAL
SG #1 NR LEVEL CHANNEL C HIGH/NORMAL
SG #1 NR LEVEL CHANNEL D HIGH/NORMAL

SG #2 NR LEVEL CHANNEL A HIGH/NORMAL
SG #2 NR LEVEL CHANNEL C HIGH/NORMAL
SG #2 NR LEVEL CHANNEL D HIGH/NORMAL

SG #3 NR LEVEL CHANNEL A HIGH/NORMAL
SG #3 NR LEVEL CHANNEL C HIGH/NORMAL
SG #3 NR LEVEL CHANNEL D HIGH/NORMAL

SG #4 NR LEVEL CHANNEL A HIGH/NORMAL
SG #4 NR LEVEL CHANNEL C HIGH/NORMAL
SG #4 NR LEVEL CHANNEL D HIGH/NORMAL

SG #1 NR LEVEL DEVIATION HIGH/NORMAL
SG #2 NR LEVEL DEVIATION HIGH/NORMAL
SG #3 NR LEVEL DEVIATION HIGH/NORMAL
SG #4 NR LEVEL DEVIATION HIGH/NORMAL

SG #1 STEAM FLOW DEVIATION HIGH/NORMAL
SG #2 STEAM FLOW DEVIATION HIGH/NORMAL
SG #3 STEAM FLOW DEVIATION HIGH/NORMAL
SG #4 STEAM FLOW DEVIATION HIGH/NORMAL

SG #1 FEED FLOW DEVIATION HIGH/NORMAL
SG #2 FEED FLOW DEVIATION HIGH/NORMAL
SG #3 FEED FLOW DEVIATION HIGH/NORMAL
SG #4 FEED FLOW DEVIATION HIGH/NORMAL

SG #1 XFER SWITCH STATUS ABNORM/NORMAL
SG #2 XFER SWITCH STATUS ABNORM/NORMAL
SG #3 XFER SWITCH STATUS ABNORM/NORMAL
SG #4 XFER SWITCH STATUS ABNORM/NORMAL

SG #1 FWCS CARD FAILURE

SG #2 FWCS CARD FAILURE
SG #3 FWCS CARD FAILURE
SG #4 FWCS CARD FAILURE

SG #1 OVERFILL PROTECTION ACTUATED/NORMAL
SG #2 OVERFILL PROTECTION ACTUATED/NORMAL
SG #3 OVERFILL PROTECTION ACTUATED/NORMAL
SG #4 OVERFILL PROTECTION ACTUATED/NORMAL

5.4.11 SPEC 200 Micro Usage

The acceptability of Foxboro SPEC 200 Micro equipment usage in safety systems of Nuclear Power Generating Stations including software validation and verification is documented in Foxboro Test Reports QOAAE01, QOAAE03, QOAAE04, and QOAAE05.

In addition, interference testing has been performed and is documented in Foxboro Test Report No. 88-1033a. This testing includes EMI and RFI testing. NUSCO will also contract an independent consultant to perform an evaluation including testing to determine that the equipment will be electromagnetically compatible with the environment.

5.4.12 Equipment Power Sources

Power to the Foxboro rack equipment will be provided as follows:

Analog Rack 1F	Vital A
Analog Rack 2F	Vital B
Analog Rack 3F	Vital C
Analog Rack 4F	Vital D
Protection Rack 1R	Vital A
Protection Rack 2R	Vital B

Protection Rack 3R	Vital C
Protection Rack 4R	Vital D
Control Rack F1/2	Semi-Vital
Control Rack F3/4	Semi-Vital

5.5 Implementation Plan

5.5.1 General

a) This plant design change will be installed and tested prior to completion of the 1993 refueling outage. Precautions shall be taken during implementation to ensure that minimum channel operability requirements are adhered to.

b) The majority of the work associated with this change will be performed during the outage, however, pre-outage work will be necessary to assure completion within the planned duration of the outage. Pre-outage work will be controlled by PDCR Section 4, Early Approval for Construction and the AWO program.

c) All electrical work shall be performed in accordance with NUSCO Specification SP-EE-076, Standard Specification for Electrical Installations as a guide. All instrumentation and instrument tubing shall be installed per NUSCO Specification SP-EE-275; Specification for Instrumentation Installation, Piping, and Tubing.

d) Any cables, portions of cables or wires left abandoned in place shall be in accordance with CY procedure ACP 1.0-3.5, "Permanently Lifted Leads."

5.5.2 Pre-Outage Construction

a) NUSCO GENERATION CONSTRUCTION (or designee) will prefabricate two transmitter racks and eight seismic transmitter mounts.

b) NUSCO GENERATION CONSTRUCTION (or designee) will install two transmitter racks in the Turbine Building. Instrument tubing, valving, conduit, and cabling will be installed to facilitate timely connection during the outage.

c) NUSCO GENERATION CONSTRUCTION (or designee) will seismically install two 2-bay secondary-side Reactor Protection cabinets (with caps and skirts) behind the Main Control Board.

d) NUSCO GENERATION CONSTRUCTION (or designee) will seismically install conduit from each secondary-side Reactor Protection cabinet to the Main Control Board, the Reactor Trip Logic Cabinets, and to the other secondary-side Reactor Protection cabinet.

e) NUSCO GENERATION TEST (or designee) will pull instrument cable in the new conduit runs. Wires will be terminated in the new cabinets and left coiled at the other end for connections during the outage.

f) NUSCO GENERATION TEST (or designee) will prefabricate Main Control Board mounting plates to facilitate board equipment installation during the outage.

5.5.3 Outage Construction

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a) NUSCO GENERATION TEST (or designee) will determinate existing wiring to the Hagan Feedwater Control System and will protect the wiring from damage.

b) CYAPCO I&C will remove the old Hagan cabinets and NUSCO GENERATION CONSTRUCTION (or designee) will seismically (2-over-1) install the new Foxboro cabinets in their place.

c) NUSCO GENERATION TEST (or designee) will pull and terminate all new/existing cables to/from the Main Control Board to/from the Foxboro cabinets.

d) NUSCO GENERATION CONSTRUCTION (or designee) will install eight seismic transmitter mounts in the mid-level Containment Outer Anulus.

e) NUSCO GENERATION CONSTRUCTION (or designee) will install all associated instrument tubing, valving, conduit, and cable to the new transmitter locations.

f) NUSCO GENERATION CONSTRUCTION and/or CYAPCO I&C (or their designees) will mount all transmitters, connect all instrument tubing, and terminate all transmitter wiring.

g) NUSCO GENERATION TEST (or designee) will terminate wiring on both sides of the containment penetration assemblies.

h) NUSCO GENERATION TEST (or designee) will mount new Main Control Board equipment in place of the obsolete equipment.

i) NUSCO GENERATION TEST (or designee) will perform Main Control Board wiring changes and equipment removals/additions.

j) CYAPCO I&C (or designee) will rearrange the existing Reactor Trip Logic cabinets to provide annunciation and computer points for secondary-side inputs.

k) CYAPCO I&C (or designee) will install I/P converters and interface the new equipment with the old final control elements.

l) NUSCO GENERATION TEST (or designee) will determinate existing wiring to the Vital A and B inverters and will protect the wiring from damage.

m) NUSCO GENERATION CONSTRUCTION (or designee) will remove the old Vital A and B inverters, the abandoned Vital C and D inverters and the ventilation hood and seismically install two Class 1E 5 kVA inverters and back-up transformers in Switchgear Room A.

n) NUSCO GENERATION CONSTRUCTION (or designee) will seismically install conduit from each inverter to the control room floor penetration and to existing cable tray.

o) NUSCO GENERATION TEST (or designee) will pull and terminate all new/existing cables to/from the inverters.

5.6 Test Plan

5.6.1 Construction Phase Testing

5.6.1.1 As-Built Verification

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a) NUSCO GENERATION CONSTRUCTION and NUSCO GENERATION TEST (or their designees) will verify the correct arrangement and mounting of added Control Room and Switchgear Room A equipment (cabinets, wireways, conduit, and Control Board mounted equipment). Signed as-built drawings shall be delivered to the Plant Engineer depicting the actual arrangements and all as-built changes.

b) CYAPCO I&C will verify the continuity and arrangement of all rearranged wiring internal to the existing Foxboro Reactor Protection System (RPS) Racks, as well as, all wiring internal to the new Foxboro Cabinets. This verification will be documented using a To/From wiring list addressing each internal wire. Additionally, CYAPCO I&C will verify the continuity and arrangement of all wiring associated with transmitter replacements and additions. CYAPCO I&C will deliver signed as-built drawings to the Plant Engineer depicting the actual arrangements and all as-built changes.

c) NUSCO GENERATION TEST will verify the continuity and arrangement of all wiring external to the Foxboro RPS Racks (excluding transmitter wiring) and the new Foxboro Cabinets. NUSCO GENERATION TEST will deliver signed as-built drawings to

the plant engineer depicting the actual arrangements and all as-built changes. Additionally, NUSCO GENERATION TEST will perform insulation resistance tests per PMP 9.8-7 on all added power cables.

d) NUSCO GENERATION CONSTRUCTION will verify the arrangement of all field mounted equipment (transmitter racks, transmitter mounts, instrument tubing, and instrument conduit). NUSCO GENERATION CONSTRUCTION will deliver signed as-built drawings to the Plant Engineer depicting actual equipment arrangements and dimensions, as well as, all as-built changes.

Note: Signed as-built drawings will be turned over to the Plant Engineer prior to preoperational testing of the plant equipment.

5.6.1.2 Installation Documents Verification

a) All installation AWOs will be complete and signed off by Generation Test, Generation Construction and Instrumentation and Controls. All associated QC checks must be complete and satisfactory.

b) The Project Engineer and Plant Engineer will verify that the entire scope of the project is complete and ready for turnover and testing.

c) All Construction Phase NCRs will be dispositioned by the Project Engineer and signed off through the Unit Superintendent prior to testing.

Note: The above three items apply to complete and partial releases.

5.6.1.3 Pre-Installation Testing

a) Individual RPS component testing and inspection will be performed at the Factory Acceptance Test per NUSCO Specification SP-EE-323.

b) The proper operation of transmitters, recorders and indicators will be verified by bench calibrations performed by CYAPCO I&C.

5.6.1.4 Installation Testing/Inspection

a) GENERATION TEST and CYAPCO I&C will perform "Red-Line" Testing per CY ACP 1.2-3.8, "Electrical Wiring Verification Functional Testing and Scheme Verification," on their respective portions of the modification. The Project Engineer and the Plant Engineer will verify that adequate overlap occurs between GT and I&C prior to energization of the RPS equipment.

b) Concrete anchor bolt and unistrut clip installation will be performed per Generation Construction approved procedures.

5.6.2 <u>Preoperational Testing</u>

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5.6.2.1 Power Supply Testing

CYAPCO I&C will test and adjust, as required, each rack power supply to verify manufacturer's specifications. Individual nest power supplies will then be tested and adjusted, as required, to verify manufacturer's specifications.

PMP 9.2-120 Foxboro SPEC 200 Multi-nest Power Supply Testing.

5.6.2.2 Loop Calibration and Loop Functional Testing

CYAPCO I&C Surveillance Procedures, Preventive Maintenance Procedures and Special Maintenance Procedures will be revised and performed as preoperational tests to verify the correct calibration and functional operability of all devices affected by this plant design change. The calibration verification test will prove that, with a known precision input, the instrument or channel gives the required output. The functional verification test will prove that the tested equipment is capable of performing its design functions including proper trip and alarm settings; proper operation of permissive, prohibit, and bypass functions; and operability of trip and bypass switches. The following procedures will be revised, as necessary, and performed:

SUR 5.2-4.5 Rack 1F/1R Periodic Surveillance (Monthly)

SUR 5.2-4.6	Rack 2F/2R Periodic Surveillance (Monthly)
SUR 5.2-4.7	Rack 3F/3R Periodic Surveillance (Monthly)
SUR 5.2-4.8	Rack 4F/4R Periodic Surveillance (Monthly)
SUR 5.2.6.1	Steam Generator #1 Narrow Range Level Calibration (Refueling)
SUR 5.2.6.2	Steam Generator #2 Narrow Range Level Calibration (Refueling)
SUR 5.2.6.3	Steam Generator #3 Narrow Range Level Calibration (Refueling)
SUR 5.2.6.4	Steam Generator #4 Narrow Range Level Calibration (Refueling)
SUR 5.2-11.1A	Steam Generator #1 Train A Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-11.2A	Steam Generator #2 Train A Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-11.3A	Steam Generator #3 Train A Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-11.4A	Steam Generator #4 Train A Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-11.1B	Steam Generator #1 Train B Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-11.2B	Steam Generator #2 B Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)

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SUR 5.2-11.3B	Steam Generator #3 B Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-11.4B	Steam Generator #4 B Steam Flow, Feedwater Flow and Steam Generator Pressure Channel Calibration (Refueling)
SUR 5.2-38	Steam Line Break Channels 1-4 Calibration (Refueling)
SUR 5.2-50	Reactor Trip Checkout
SUR 5.2-124.1	Reactor Trip Logic Cabinet A1 Coincidence Test (Six Week)
SUR 5.2-124.2	Reactor Trip Logic Cabinet A2 Coincidence Test (Six Week)
SUR 5.2-124.3	Reactor Trip Logic Cabinet B1 Coincidence Test (Six Week)
SUR 5.2-124.4	Reactor Trip Logic Cabinet B2 Coincidence Test (Six Week)
PMP 9.2-120	Foxboro Multinest Power Supply Testing
PMP 9.2-161	Primary Side First Out Annunciator Verification
PMP 9.2-NEW.1	Loop 1 Feedwater Control Calibration
PMP 9.2-NEW.2	Loop 2 Feedwater Control Calibration
PMP 9.2-NEW.3	Loop 3 Feedwater Control Calibration
PMP 9.2-NEW.4	Loop 4 Feedwater Control Calibration
ST 11.2-X1	RPS Upgrade Phase III (PDCR 1331 Safety Related Equipment) Pre-Operational Test
ST 11.2-X2	RPS Upgrade Phase III (PDCR 1331 Feedwater Control Equipment) Pre-Operational Test
ST 11.2-X3	RPS Phase III Integrated Test

ST 11.2-X4	Feedwater Control System Failure Mode Verification
CMP 8.2-26	Insertion and Restoration of Signals

5.6.2.3 Inverter Testing

a) GENERATION TEST will perform Inverter Phase I and Phase II tests.

b) GENERATION TEST will test molded case circuit breakers in accordance with CY procedure PMP 9.8-88, "Testing of Molded Case Circuit Breakers and Motor Circuit Protectors."

5.6.2.4 Loss of Power Testing

This testing will be performed to demonstrate redundancy and electrical independence. This testing will also verify that all equipment affected by the loss of power will fail to a safe state. The following test procedure will be written and performed:

PMP 9.2-NEW.1	Loss of Nest Power Panel 1R
PMP 9.2-NEW.2	Loss of Nest Power Panel 2R
PMP 9.2-NEW.3	Loss of Nest Power Panel 3R
PMP 9.2-NEW.4	Loss of Nest Power Panel 4R

5.6.2.5 Pressure Testing

CYAPCO OPERATIONS will perform a visual check of all added or modified instrument tubing.

5.6.3 <u>Periodic Post-Installation Testing</u>

a) CYAPCO I&C Surveillance Procedures will be performed periodically, as required by Technical Specifications to verify operability of the safety system.

5.7 Quality Questions

Does this plant design change involve systems, components or structures that are:

	Yes	No
QA Category 1	[x]	[ ]
Radwaste QA	[ ]	[x]
Fire Protection QA	[x]	[ ]
ATWS QA	[ ]	[x]