Florida Power
CORPORATION

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Title ANTICIPATED TRANSIENT WITHOUT SCRAM (ATWS)

CONCEPTUAL DESIGN

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NUCLEAR ENGINEERING DEPARTMENT
CRYSTAL RIVER - UNIT 3
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FLORIDA POWER
CORPORATION

84-06-01-01
REI/MAR NO.

Anticipated Transient
Without Scram (ATWS)
Project Title

Conceptual Design
for
Crystal River Unit 3
Nuclear Engineering

P.V. Riddle
Prepared by

10/28/86
Date

W.A. Gaston
Reviewed by

10/29/86
Date

ANTICIPATED TRANSIENT WITHOUT SCRAM (ATWS) CONCEPTUAL DESIGN

I. Project Design Basis

A. Specific Codes and Standards

The following applies for equipment being installed in existing safety systems to be environmentally qualified for normal operation and seismically qualified so as not to degrade the safety related equipment.

The applicable codes and standards for interfaces between non-safety and safety systems are:

IEEE 279-1971 Section 4.7	Criteria for Protection Systems for Nuclear Power Generating Stations.
IEEE 323-1974	IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.
IEEE 344-1975	Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.
CR-3-E247-A	Electrical Separation Criteria for Control Boards, Equipment Cabinets and Relay Racks.
10CFR50 Appendix R	

The applicable NRC requirements concerning the ATWS System (Diverse Scram System (DSS) and ATWS Mitigating System Actuation Circuitry (AMSAC)) are:

10CFR50.62	Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water Cooled Nuclear Power Plants.
NRC Generic Letter 85-06	Quality Assurance Guidance for ATWS Equipment that is not safety-related.

B. Safety Classification

The ATWS system, DSS and AMSAC, are non-safety systems and these portions are described in the NRC Generic Letter 85-06. ATWS is not designed to meet IEEE 279, however it is designed and engineered for high reliability to preclude unnecessary challenges to existing safety systems. The interfaces with the safety related systems, Remote Shutdown System (RSS), Gamma Metrics (GM), and Emergency Feedwater Initiation and Control System (EFIC) will be treated as safety related.

C. Identification of Major Equipment

1. Remote Shutdown Auxiliary Equipment (RSAE) Cabinets: Provide DSS isolated analog signals for Reactor Coolant (RC) wide range pressure to the NNI cabinets.

2. Gamma Metrics Channels: Provide AMSAC isolated analog signals for reactor power level to the NNI cabinets.

3. NNI Cabinets: a) Provide DSS test capability, signal processing of RC wide range pressure, and CRD trip and enable contact outputs, and b) Provide AMSAC test capability, signal processing of MFW flow and reactor power level, alarm outputs, trip contact outputs to turbine generator main control board (MCB) TGR panel and Emergency Feedwater (EFW) initiate contact outputs to EFIC cabinets (A and D only).

4. CRDCS Cabinets: Provide DSS test capability, relay logic for trip enable, channel interlock, trip lockup/reset, alarm outputs, and SCR gate drive trip outputs to regulating rod group power supplies.

5. MCB TGR: Provide relay logic for AMSAC turbine generator trips.

6. EFIC Cabinets: Provide digital isolation for AMSAC trip inputs from NNI and the logic necessary to initiate EFW from anticipatory trip input.

7. SER Cabinet: Provide logic for test and trip alarms for DSS and AMSAC. This is a programming function only and will not require any internal rewiring.

D. Functional Description

1. DSS

The principal function of the DSS is to prevent an ATWS by tripping the reactor if, for any reason, the rods have failed to drop in response to an RPS trip. The DSS must function to provide reactor trip, diverse from the existing Reactor Trip System (RTS), for all ATWS transients which require reactor trip (in addition to AMSAC actions) to prevent a potential for damaging over pressurization of the RCS. A design standard for DSS pressure limitation has been arbitrarily set at 3250 psia as stated in B&W Document 47-1158904-00.

2. AMSAC

The principal function of the AMSAC is to mitigate the effects of an ATWS in the unlikely event of no rod drop from either RPS or DSS. The AMSAC must function to actuate EFW and trip the turbine on ATWS transients where required to prevent serious RCS over pressurization, maintain fuel integrity and meet 10CFR release requirements. A design standard for AMSAC pressure limitation has been arbitrarily set at 4000 psia in accordance with the analyses in BAW-1610.

The ATWS transients of concern for the B&WOG plants have been shown to be the Loss of Main Feedwater (LMFW) and the Loss Of Offsite Power (LOOP) leading to LMFW.

Consideration for avoidance of inadvertent actuation dictate that there be at least two channels, powered from separate sources, coupled with appropriate coincidence capability.

E. Preliminary Layouts

See attachments 1 and 2.

F. Preliminary Flow Diagrams

Not applicable

G. Identification of Interfaces and Interface Requirements

The interfaces with IE systems will be designed to meet the applicable codes and standards listed in Section A above.

The following is a list of the interfaces:

1. DSS

From	To	Isolation
RSAE Cabinets A&B	Non-Nuclear Instrumentation (NNI) cabinets	1E to $\overline{1E}$
NNI Cabinets	Control Rod Drive Control System (CRDCS) Cabinets	$\overline{1E}$ to $\overline{1E}$
CRDCS Cabinets	Sequence of Events Recorder (SER)	$\overline{1E}$ to $\overline{1E}$

2. AMSAC

Gamma Metrics (GM) Channels A&B	NNI Cabinets	1E to $\overline{1E}$
NNI Cabinets	EFIC A&D	$\overline{1E}$ to 1E
NNI Cabinets	MCB TGR	$\overline{1E}$ to $\overline{1E}$
NNI Cabinets	SER	$\overline{1E}$ to $\overline{1E}$

See Preliminary Interface Requirements, Attachment 3, for detailed interfaces.

H. Identification of Control and Logic Requirements, and All Interlocks

1. DSS & AMSAC

a. Primary input signals will be diverse from existing protection systems from the sensor output to final actuation device.

b. The system will be electrically independent from existing protection systems.

c. Channel separation shall be provided in accordance with plant specific requirements for routing non-safety signals.

d. The system shall be designed to minimize challenges to safety systems. This requirement dictates the use of at least two channels with appropriate coincidence logic. Both systems will employ an "energize-to-trip" logic.

e. To avoid the potential for inadvertent actuations of this non-safety system, the system shall be designed so as not to revert to a 1-out-of-1 status during channel test. This dictates that the system shall become inoperable during channel test.

f. The system shall be designed such that electronic delay shall contribute no more than one second to the overall time required to actuate the final actuated device.

g. The system shall incorporate a channel test capability. All power tests shall be performed at 6 month intervals. Complete system tests shall be performed every refueling. The test function should simultaneously test a channel together from sensor to final actuated device.

Except for DSS: Input sensors.

Except for AMSAC: Input sensors, final actuated device.

h. The system shall be designed to provide status output to the control room for channel trip, system trip and test status.

2. DSS Only

a. The DSS shall cause a reactor trip by interrupting power to the SCR gate drivers for rod groups 5-7 and auxiliary power supplies by a means other than the existing SCR control relays driven by RPS.

b. To prevent CRDM damage due to rachet trip (attempted re-energization of CRDM with a moving leadscrew), the DSS shall incorporate trip lock up and manual reset activated by a true DSS trip.

c. DSS is based on using a Very High RCS Pressure input and shall use a setpoint of 2450 ± 25 psig.

d. No startup bypass is required on DSS with the reactor coolant pressure signal as the trip signal.

e. DSS channels shall be configured with a total input instrument string error of no more than 1% under normal operation.

3. AMSAC Only

a. The AMSAC shall initiate EFW and cause a turbine trip by actuating devices that are within the existing circuitry for EFW initiation (EFIC) and the turbine trip circuits.

b. AMSAC shall be designed to actuate the AMSAC features on a trip setpoint representative of a complete (100%) loss of feedwater flow.

c. Startup bypass on conditions of reactor power greater than 25% full power for AMSAC will be automatically removed. Manual actuation can be achieved by placing the channel in test.

d. AMSAC has no stated accuracy requirement.

4. See Attachment 4 for DSS Logic, one-line, and Schematic Sketches, and Attachment 5 for AMSAC One-line and Schematic Sketches.

I. Identification of Specific Power Sources and Requirements

1. Safety related power supply is not required. Operability during Loss Of Offsite Power is required.

2. DSS

   a. CRDM de-energization resulting from a LOOP will accomplish the intended function of DSS. Thus DSS need not be supplied from safety related sources. Supply of the DSS from safety related sources is permissible, providing that appropriate separation and isolation is maintained.

   b. FSAR Section 14, page 14-25 (Loss of All Power) 14.1.2.8.4.a) states "a loss of power results in gravity insertion of the control rods and trip of the turbine valves."

3. AMSAC

   a. Continued operability during LOOP dictates that AMSAC power be derived from safety related sources. The AMSAC equipment housed in the NNI cabinets receive power from both vital and regulating sources. The equipment housed in GM and EFIC are also powered from battery backed vital sources. The battery backed vital source provides for proper operation of the AMSAC equipment during a loss of offsite power.

J. Identification of Instrumentation and Requirements

Refer to preliminary Bill of Material, Attachment 6, for detailed items contained in the following equipment.

a. NNI Cabinets X&Y

b. RSAE Cabinets A&B

c. CRDCS Cabinets

d. MCB TGR

e. EFIC A&B

See applicable codes and standards in Section A above for the requirements on DSS and AMSAC instrumentation.

K. Identification of Specific Terminations for all Existing Electric Tie-ins

1. DSS - Input/Output List

NNI-X

2-5-1-1, 2&18	Input from RSAE Cab. A (RC Press)
2-7-2-23&24	Output - CRD Enable
2-7-3-3&4	Output - CRD Trip 1
2-7-5-17 thru 20	Input - CRD Contacts for Test Lamps

NNI-Y

8-7-6-10,11&12	Input from RSAE Cab. B (RC Press)
8-7-6-1&2	Output - CRD Enable
8-7-6-3&4	Output - CRD Trip 2
8-7-6-5 thru 8	Input - CRD Contacts for Test Lamp

RSAE Cab. A

TB5-4,5&6	Output to NNI-X (RC Press)

RSAE Cab. B

TB5-4,5&6	Output to NNI-Y (RC Press)

CRDCS DC Hold Supply Cabinet A (New Terminal Blocks)

TB14-1 thru 8	Input from NNI-X (Enable & Trip) and Output to NNI-X (Indication)
TB13-1&2	Output to SER (Enable)
-3&4	Output to SER (Trip 1)
-5&6	Output to SER (Trip 1)
TB10-1 thru 10	AC PWR and SCR Row Trips
TB12-1 thru 8	Input from NNI-Y (Enable & Trip) and Output to NNI -Y (Indication)
TB11-1&2	Output to SER (Enable)
-3&4	Output to SER (Trip 2)
-5&6	Output to SER (Trip 2)
TB9-1 thru 10	AC PWR & SCR Row Trips
Each SCR Cabinet	5A,6A,7A & Aux(A) TB11-5&8-Trip Wires

SER - To be assigned

2. AMSAC - Input/Output List

GM Channel A

TB2 1,2&3	Output to NNI X(Neutron Flux Signal, 0-10V)

GM Channel B

TB2 1,2&3	Output to NNI Y(Neutron Flux Signal, 0-10V)

NNI-X

2-9-5-13,14&4	Input from GM A (Neutron Flux Signal)
2-9-3-7&8	Output to EFIC A (AMSAC Trip)
2-9-3-11,12,19&20	Output to Turbine MCB TGB (AMSAC Trip & Conf.)
2-9-4-18&19	Output to SER (Test Alarm)
2-9-4-20&21	Output to SER (Trip Alarm)
2-9-4-22&23	Output to SER (Trip Alarm)

NNI-Y

8-7-2-13,14&6	Input from GM B (Neutron Flux Signal)
8-7-2-7&8	Output to EFIC D (AMSAC Trip)
8-7-2-15,16,17&18	Output to Turbine MCB TGR (AMSAC Trip)
8-7-2-19&20	Output to SER (Test Alarm)
8-7-2-21&22	Output to SER (Trip Alarm)
8-7-2-23&24	Output to SER (Trip Alarm)

EFIC A

TBD7-9&10	Input from NNI-X (Trip)
TBE2-7&8	Input from Isolator

EFIC D

TBD7-9&10	Input from NNI-Y (Trip)
TBE12-7&8	Input from Isolator

MCB TGR

TB15-17&18	Input from NNI-X (Trip)
TB15-19&20	Output to NNI-X (Confirm)
TB15-21&22	Input from NNI-Y (Trip)
TB15-23&24	Output to NNI-Y (Confirm)

SER - To be assigned

L. Preliminary Safety Analysis

See Modification Safety Evaluation, Attachment 7.

Preliminary safety analysis indicates a potential for Technical Specification change. Engineering Project Manager must inform Nuclear Licensing and the Site Project Manager.

M. ALARA Criteria and Approach

Not Applicable

N. Environmental Qualification Implications

1. Florida Power Corporation's Environmental and Seismic Qualification Guide Specification and Data SP-5095 Zone #13 Elevation 145'- 0" specifies the environmental conditions at the SER, NNI, and MCB TGR locations. The environmental conditions are:

Temperature	70-80°F
Radiation	$1x10^4$ Rad - 40 year Total Integrated Dose

2. Zone #43 Elevation 108' 0" specifies the environmental conditions at the RSAE Cabinets and Zone #58 Elevation 124'- 0" for the CRD Cabinets, EFIC, and GM. The environmental conditions are the same for Zones #43 and 58 and are:

Temperature	70-80°F
Relative Humidity	40-60%
Radiation	$1x10^4$ Rad - 40 year Total Integrated Dose

O. Fire Plan Implication

Not applicable

II. Total Project Scope and Work Breakdown

A. General Total Project Scope

1. Detailed Design Package (MAR)

   a. Design Development
   b. Site Visits
   c. Verification
   d. Project Cost Estimate & Schedule

2. Purchase Equipment

   a. Bailey
   b. Grayhill
   c. Vitro
   d. Dialight
   e. Potter & Brumfield
   f. MMIS

3. Conduit Hangers

   a. Evaluation of Old
   b. Design New
   c. Manufacture New
   d. Install New

4. Conduit Installation

5. Cable Installation

6. Fabricate Test Switch Module

7. Fabricate Test and Relay Panel for CRDCS

8. Install DSS Equipment & Wiring

   a. RSAE Cabinets A&B
   b. NNI Cabinets 2,3,5,7&8
   c. CRDCS DC Hold Supply Cabinet A and SCR Power Supply Cabinets

9. Install AMSAC Equipment & Wiring

   a. NNI Cabinets 2,3,5,6&8
   b. MCB TGR Panel
   c. EFIC Cabinets A&D

10. Terminate Cables for DSS

    a. RSAE Cabinets A&B (to NNI 2&8)
    b. NNI Cabinets 2&8 (from RSAE A&B and to CRDCS)
    c. CRDCS DC Hold Supply Cabinet A (from NNI 2&8 and to SER)
    d. SER (from CRDCS)

11. Terminate Cables for AMSAC

    a. GM Channels A&B (to NNI 2&8)
    b. NNI Cabinet 2 (from GM A and to MCB TGR, EFIC A and SER)
    c. NNI Cabinet 8 (from GM B and to MCB TGR, EFIC D and SER)
    d. MCB TGR panel (from NNI 2&8)
    e. EFIC A (from NNI 2)
    f. EFIC D (from NNI 8)
    g. SER (from NNI 2&8)

12. System Testing

    a. DSS
    b. AMSAC

13. Final As-Built Drawings

14. Instruction Manual Updates

15. Project Closeout

B. Detailed Engineering Scope

1. Tasks and Outputs

a. MAR Package (A/E)

(1) Administrative and Technical Support Information.

(a) Transmittal Memo
(b) MAR Form
(c) Project Assignment Memo
(d) Design Data Sheet
(e) Design Input Record
(f) Correspondence Related to Design

(2) Design Support

(a) Verification Report
(b) Analysis/Calculation Sheets
(c) Engineering Study
(d) Work Order
(e) REI Form
(f) Data Transmittal sheets

(3) Installation, Examination, Test & ISI Requirements

(a) Engineering Instruction
(b) Interim Drawings
(c) MAR Sketches
(d) Cable Pulling and Data Sheets
(e) Cable Termination and Test Data Sheets
(f) Bill of Materials
(g) Vendor Information

(4) Reference Material

(a) Reference Drawings
(b) Procurement Requisitions/Purchase Orders

b. Interface with A/E

(1) St. Petersburg Engineering, I&C (80%) and Electrical (20%)

c. Review and Approval of MAR Package

(1) St. Petersburg Engineering, I&C (80%) and Electrical (20%)

d. Interface With Site Engineering

(1) St. Petersburg Engineering, I&C (80%) and Electrical (20%)

e. Interface With Plant Engineering

(1) St. Petersburg Engineering, I&C (80%) and Electrical (20%)

2. Interim Drawings

a. DSS

(1) RSAE A&B

E-201-337
SS-211-047, RC-I
B-205-019
Equipment Lists & Bill of Materials

(2) RSAE A

EC-210-746
EC-210-747
212's

(3) RSAE B

EC-210-749
EC-210-750
212's

(4) NNI

D8034033 Sh. 5&6
D8034013
D8034044
D8034023
D8034042 Sh. 2&3
Module Arrangement List Cab. 3 Row 3&4
Cab. 5 Row 3&4
Cab. 7 Row 3&4
Cab. 7 Row 5&6
EC-209-178 Sh. 1&2
EC-209-179 Sh. 2

(5) CRDCS

EC-209-024, DR-15
SS-211-024, DR-22
707101-1253
707091-1255
707100-1049
707083-1032
707356-1248
703007-1257
212's

(6) SER

B-204-024
RIS B-1013-586 Sh (no. to be determined)
EC-209-168

b. AMSAC

(1) Gamma Metrics

SS-211-042, NI-25
SS-211-042, NI-24
209-042, NI-03
209-042, NI-04
212's

(2) NNI

D8034042 Sh. 2&3 (identified above)
D8084034 Sh. 1,2,3&4
D8034017
D8034021
EC-209-178 Sh. 2 (identified above)
EC-209-179 Sh. 2 (identified above)
Module Arrangement List Cab. 3 Row 3&4
Cab. 5 Row 3&4
Cab. 6 Row 3&4

(3) EfIC

3801-3003 Sh. 1&2
3801-3008 Sh. 4&7
3801-3005 Sh. 1
3801-3021 Sh. 1
EC-210-769
EC-210-773
SS-211-026 Sh. EF-I3 & EF-22
212's

(4) MCB TGR

B-208-057 Sh. TB-20
EC-210-051
EC-210-052
E-201-135
SS-211-057 Sh. TB-20
Equipment List and Bill of Material for TGR

(5) SER

B-204-024
RIS B-1013-586 Sh (no. to be determined)

c. DSS & AMSAC Conduit

224-103 Sh. 35,36,42.224,63 & 170
E-215-031 Sh. 2
E-215-032 Sh. 2&3
E-215-033 Sh. 1

3. New Drawings

a. DSS

(1) CRDCS

EC-209-024,DR-15A
EC-201- For test and
EC-210- relay panels and trip box

b. AMSAC

(1) NNI

D8034034 Sh. 5

(2) EFIC

(Existing Vitro drawings - New FPC release)

3801-1123
3801-1124
0423-2645

4. Revised Specifications

None

5. New Specifications

None

6. Analysis

a. Seismic & Environmental

(1) RSAE Cabinets A&B
(2) EFIC Cabinets A&D
(3) GM Cabinets A&B

b. Calculations

(1) Time Delay Calculations for DSS & AMSAC
(2) Accuracy Calculations for DSS

7. Trips

a. CR-3 Site

(1) Detail Design Development

(a) One Engineer from A/E
(b) One Engineer from St. Petersburg or Site Engineering

(2) Confirmation Walkdown

(a) One Engineer from A/E
(b) One Engineer from St. Petersburg Engineering
(c) One Engineer from Site Engineering
(d) One Engineer from Plant Engineering
(e) Operations Personnel
(f) Maintenance Personnel
(g) Training Personnel

8. Assumptions

a. CRD safety groups 1,2,3 and 4 will not be tripped by the DSS.

b. DSS and AMSAC test and trip status will not be input to RECALL/SPDS or the plant annunciator.

c. The NRC review, approval, and/or comments on the B&W Owners Group "Design Requirements for DSS and AMSAC" (B&W Document 47-1159091-00) will not change the requirements of that document or any work done for the conceptual design.

d. The mass and thermal loads added by the new equipment will be within the qualification envelope of the EFIC system, RSAE cabinets, and GM channels.

e. It is assumed that the wide range RC pressure transmitters RC 158-PT and RC 159-PT will be calibrated for a 0-3000 psig range by another MAR.

f. It is assumed that the GM Channel A will be added by another MAR.

g. It is assumed that if the time delay and accuracy requirements cannot be met that the setpoints will be set as not to violate the analysis.

9. Exclusions

None

10. Deliverables

a. Complete MAR Package

b. Project Cost Estimate and Schedule

c. Seismic and Environmental Analysis

d. Time Delay and Accuracy Analysis

C. <u>Installation Work Breakdown</u>

1. Outage/Non-Outage

a. Outage

(1) Install DSS Equipment (See II.A.8.)
(2) Install AMSAC Equipment (See II.A.9.)
(3) Terminate Cable for DSS (See II.A.10.)
(4) Terminate Cable for AMSAC (See II.A.11.)
(5) System Testing for DSS and AMSAC

b. Non-Outage

(1) MAR Package (See II.A.1)
(2) Purchase Equipment (See II.A.2)
(3) Conduit Hangers (See II.A.3)
(4) Conduit Installation
(5) Cable Installation
(6) Fabricate Test Switch Module
(7) Fabricate Test Panel for CRDCS
(8) Final As-Built Drawing
(9) Instruction Manual Updates
(10) Project Closeout

2. Safety/Non-Safety

a. Safety

(1) MAR Package

(a) Interfaces with Safety Systems Only (See I.G)

(2) Purchase Equipment

(a) Vitro
(b) Safety related MMIS items (See Bill of Material

(3) Install DSS Equipment in RSAE Cabinets A&B

(4) Install AMSAC Equipment in EFIC Cabinets A&D

(5) Terminate Cables for DSS in RSAE Cabinets A&B

(6) Terminate Cables for AMSAC in:

(a) GM Channels A&B
(b) EFIC Cabinets A&D

(7) System Testing DSS

(a) RSAE Cabinets A&B

(8) System Testing AMSAC

(a) GM Channels A&B
(b) EFIC Cabinets A&D

(9) Final As-Built Drawings

(a) DSS

See II.B.2.a.1,2&3, and II.B.2.c

(b) AMSAC

See II.B.2.b.1,&3, II.B.2.c, and II.B.3.b.2

(10) Seismic and Environmental Analysis

(a) RSAE Cabinets A&B
(b) EFIC CAbinets A&D
(c) GM Channels A&B

b. Non-Safety

(1) MAR Package

(a) Everything except interfaces with safety systems (See II.C.2.a.1)

(2) Purchase Equipment

(a) Bailey
(b) Crayhill
(c) Dialight
(d) Non-safety MMIS items (See Bill of Material)

(3) Conduit Hangers (See II.A.3)

(4) Conduit Installation

(5) Cable Installation

(6) Fabricate Test Switch Module

(7) Fabricate Test and Relay Panel for CRDCS

(8) Install DSS Equipment and Wiring

(a) NNI Cabinets 2,3,5,7&8
(b) CRDCS DC Hold Supply Cabinet A and SCR Power Supply Cabinets

(9) Install AMSAC Equipment and Wiring

(a) NNI Cabinets 2,3,5,6&8
(b) MCB TGR Panel

(10) Terminate Cables for DSS

(a) NNI Cabinets 2&8
(b) CRDCS DC Hold Supply Cabinet A
(c) SER

(11) Terminate Cables for AMSAC

(a) NNI Cabinet 2&8
(b) MCB TGR Panel
(c) SER

(12) System Testing DSS

(a) NNI Cabinets
(b) CRDCS DC Hold Supply Cabinet A
(c) SER

(13) System Testing AMSAC

(a) NNI Cabinets
(b) MCB TGR Panel
(c) SER

(14) Final As-Built Drawings

(a) DSS

(1) II.B.2.a.4,5&6 and II.B.3.a.1

(b) AMSAC

(1) II.B.2.b.2,4&5 and II.B.3.b.1

3. Craft

a. Electrical

(1) Conduit Hangers
(2) Conduit Installation
(3) Cable Installation
(4) Terminate Cables for DSS
(5) Terminate Cables for AMSAC

b. I&C

(1) Fabricate Test Switch Module
(2) Fabricate Test and Relay Panel for CRDCS
(3) Install DSS Equipment
(4) Install AMSAC Equipment
(5) System Testing

4. Plant Area

Modifications will be made in the following plant areas:

See conduit layout sketches, Attachment 8, for layout for areas a,c,e&g.

(a) RSAE Cabinets A&B

Control complex elev. 108' 0" 4160V ES SWGR Rooms A&B

(b) NNI Cabinets 2,3,5,6,7&8

Control complex elev. 145' 0" Control Room

(c) CRDCS Cabinets

Control complex elev. 124' 0" CRD Room

(d) SER

Control complex elev. 145' 0" Control Room

(e) GM Channels A&B

Control complex elev. 124' 0" 480V SWGR Rooms A&B

(f) MCB TGR Panel

Control complex elev. 145' 0" Control Room

(g) EFIC Cabinets A&D

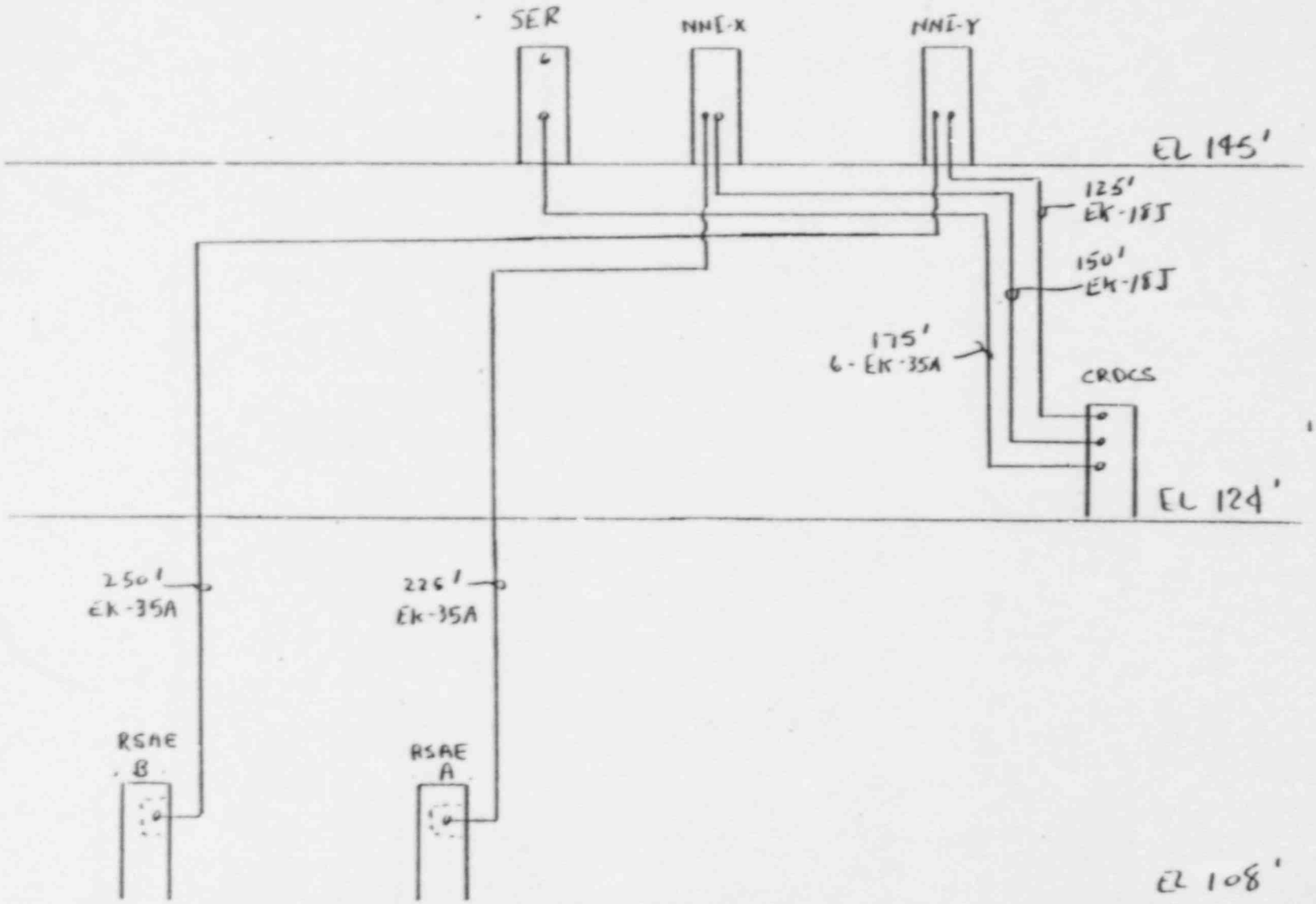
Control complex elev. 124' 0" EFIC Rooms

5. Controlled Work Area/Non-Controlled Work Area

All work to be done is in a controlled work area.

6. High Radiation Zone/Low Radiation Zone

All work to be done is in a low radiation zone.

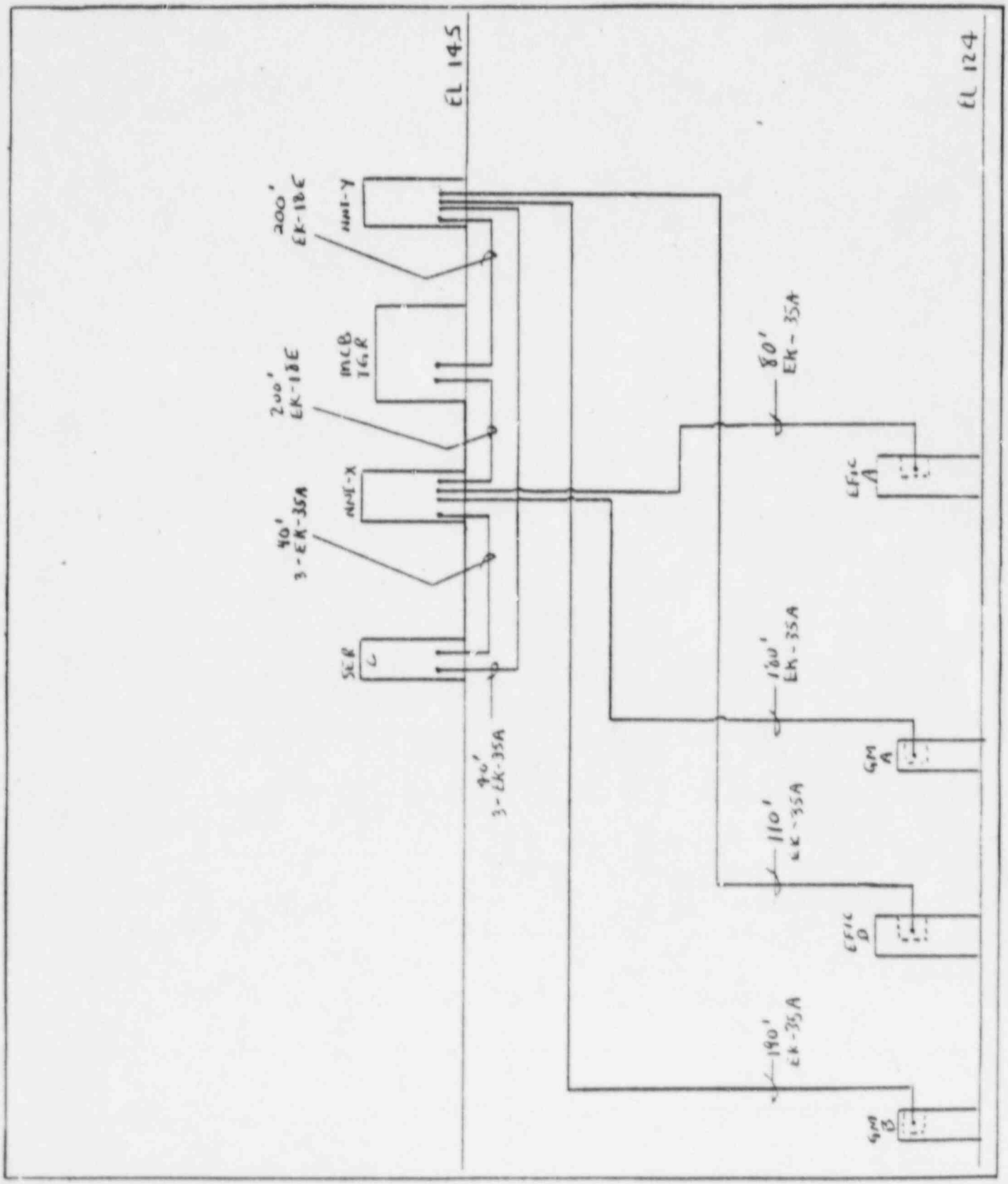


ATWS CONCEPTUAL DESIGN
Attachment 1
DSS Layout

ATWS CONCEPTUAL DESIGN

Attachment 2

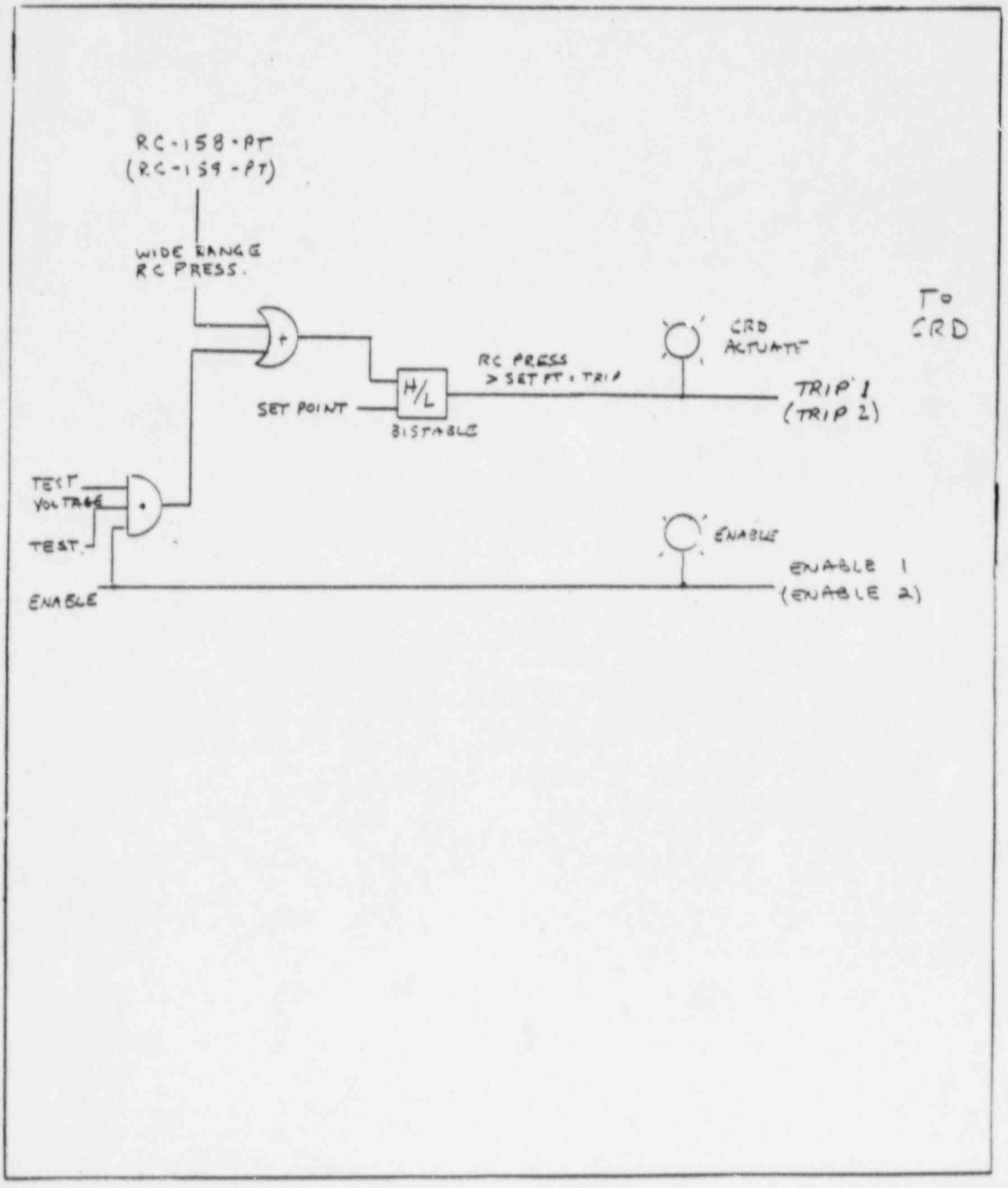
AMSAC Layout



ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 1 of 12

DSS Logic - MNI



ATWS CONCEPTUAL DESIGN

Attachment 3

Preliminary Interface Requirements

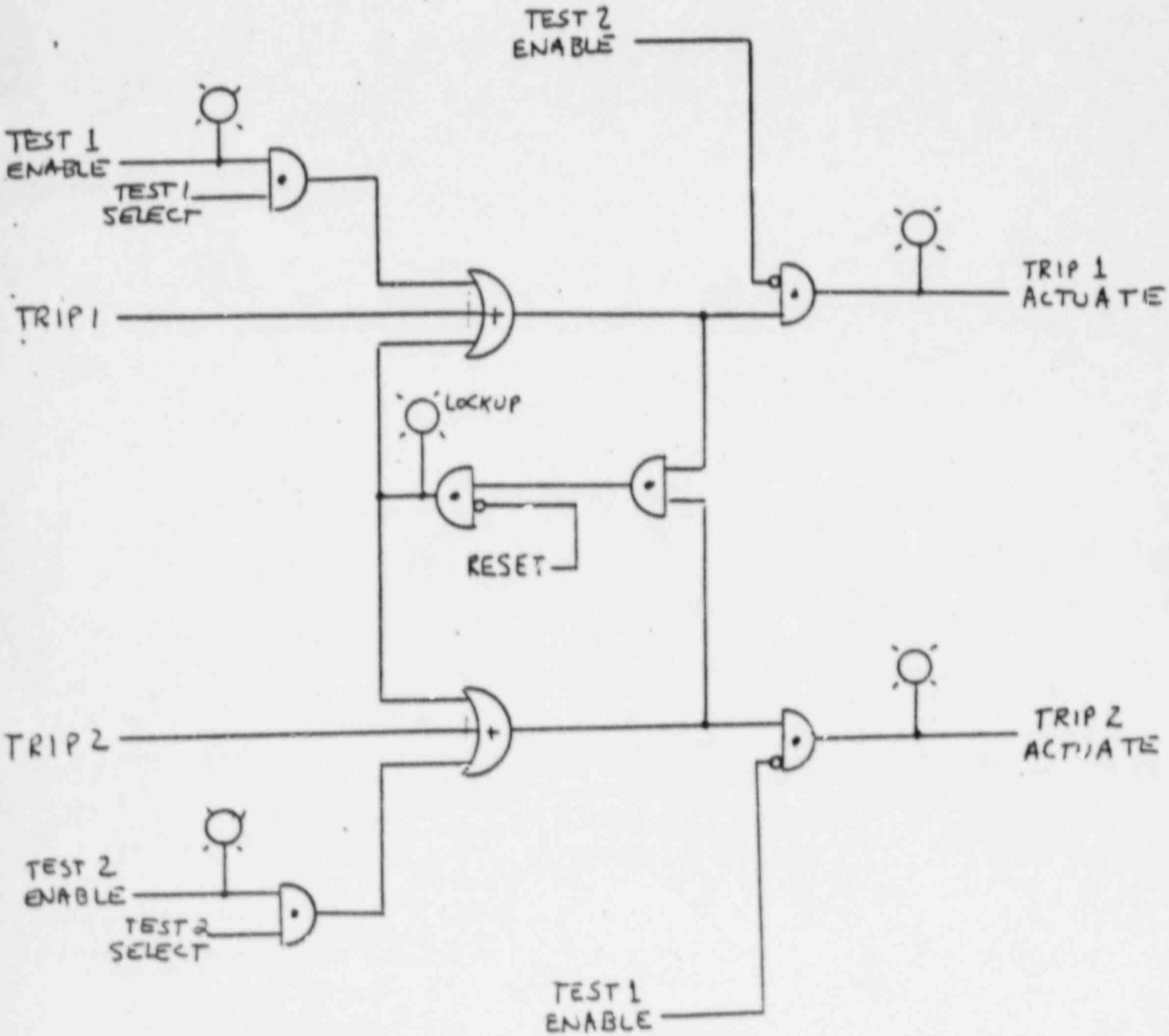
Location	Function	Requirements
RSAE Cabinets A&B	Provide isolated RC Wide Range Pressure Signal to NNI Cabinets	1. Qualified device for analog isolation(1E to 1E). 2. Output 0-10VDC represents 0-3000 psig. 3. Will be referenced to NNI signal common.
NNI Cabinets	Trip & Enable Contacts to CRDCS DC Hold Supply Cabinet A	1. Contact rating, 120VAC, 2 amp minimum.
CRDCS DC Hold Supply Cabinet A	Test & Confirm contacts for NNI lamps	1. Contact rating, 120VAC, 1 amp minimum. 2. To light high brightness neon lamps.
	Test & Confirm contacts for SER input	1. Contact rating, 125VDC, 1/2 amp minimum.
	Power for DSS Circuitry-from Power Distribution Panel	1. Burden @120VAC; 280VA inrush 118VA sustained maximum.

Location	Function	Requirements
Gamma Metrics Channels A&B	Provide isolated Reactor Power Level Signals to NNI Cabinets	1. Qualified device for analog isolation (1E to 1E). 2. Output 0-10VDC represents 10^{-8} to 200 % Full Power. 3. Will be referenced to NNI signal common.
NNI Cabinets	EFW Actuation Contacts to EFIC	1. Contact rating, 120VAC, 1 amp minimum.
EFIC Cabinets A&D	EFW Actuation Digital Signal Isolation	1. Qualified Digital isolation device (1E to 1E). 2. Input ($\overline{1E}$): 120VAC applied is low resistance output. 3. Output resistance low/high compatible with EFIC logic.
NNI Cabinets	Turbine Trip Relay Contacts	1. Contact Rating, 120VAC, 2 amp minimum.
	Test and Confirm Contacts for SER input	1. Contact Rating, 125VDC, 1/2 amp minimum
MCB TGR	Turbine Trip Relays	1. Coil, 120VAC, 1 amp maximum. 2. Contact Rating, 125VDC, 2 amp inductive minimum (actuated device zener-zener

ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 2 of 12

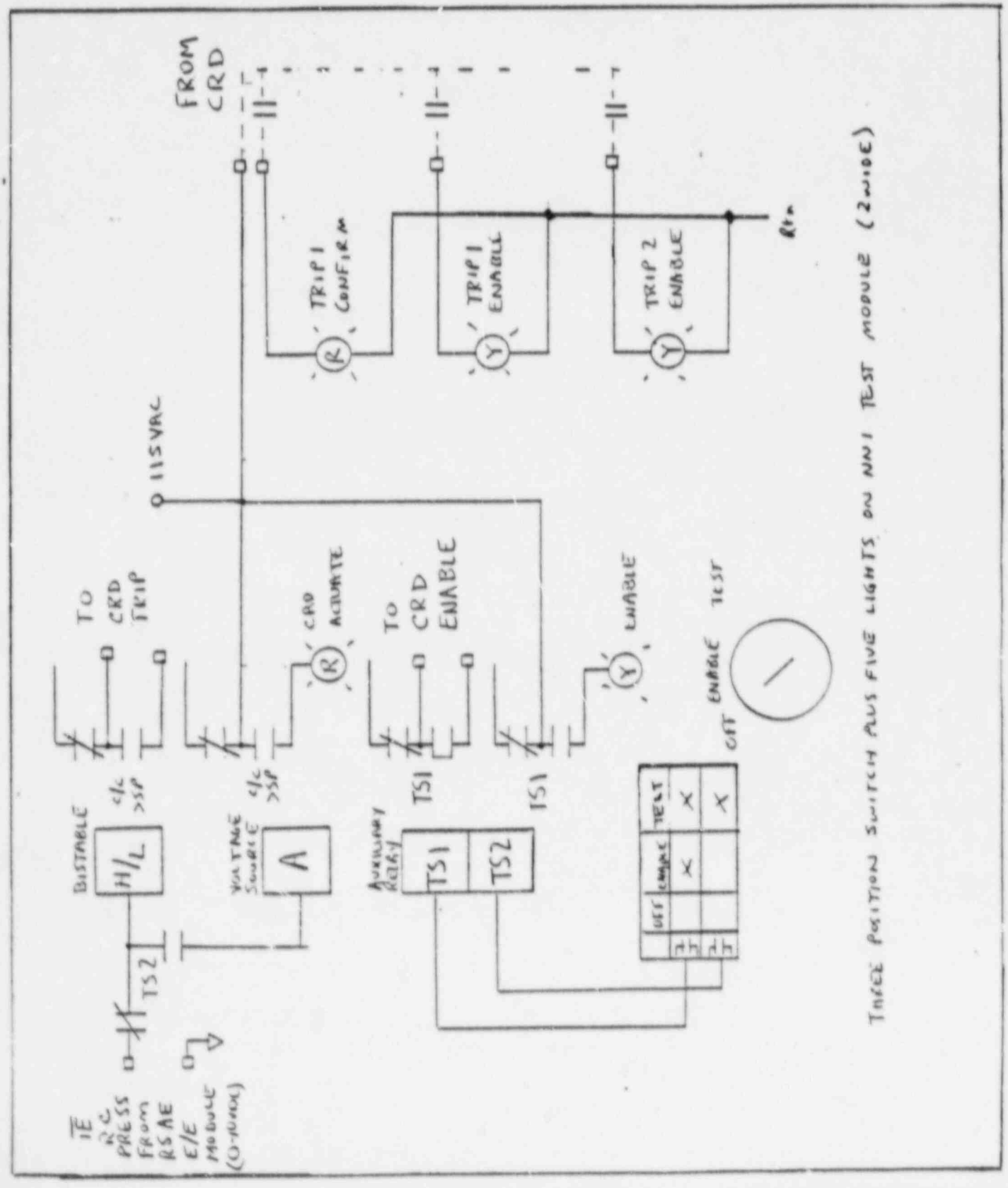
DSS Logic - CRD



ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 3 of 12

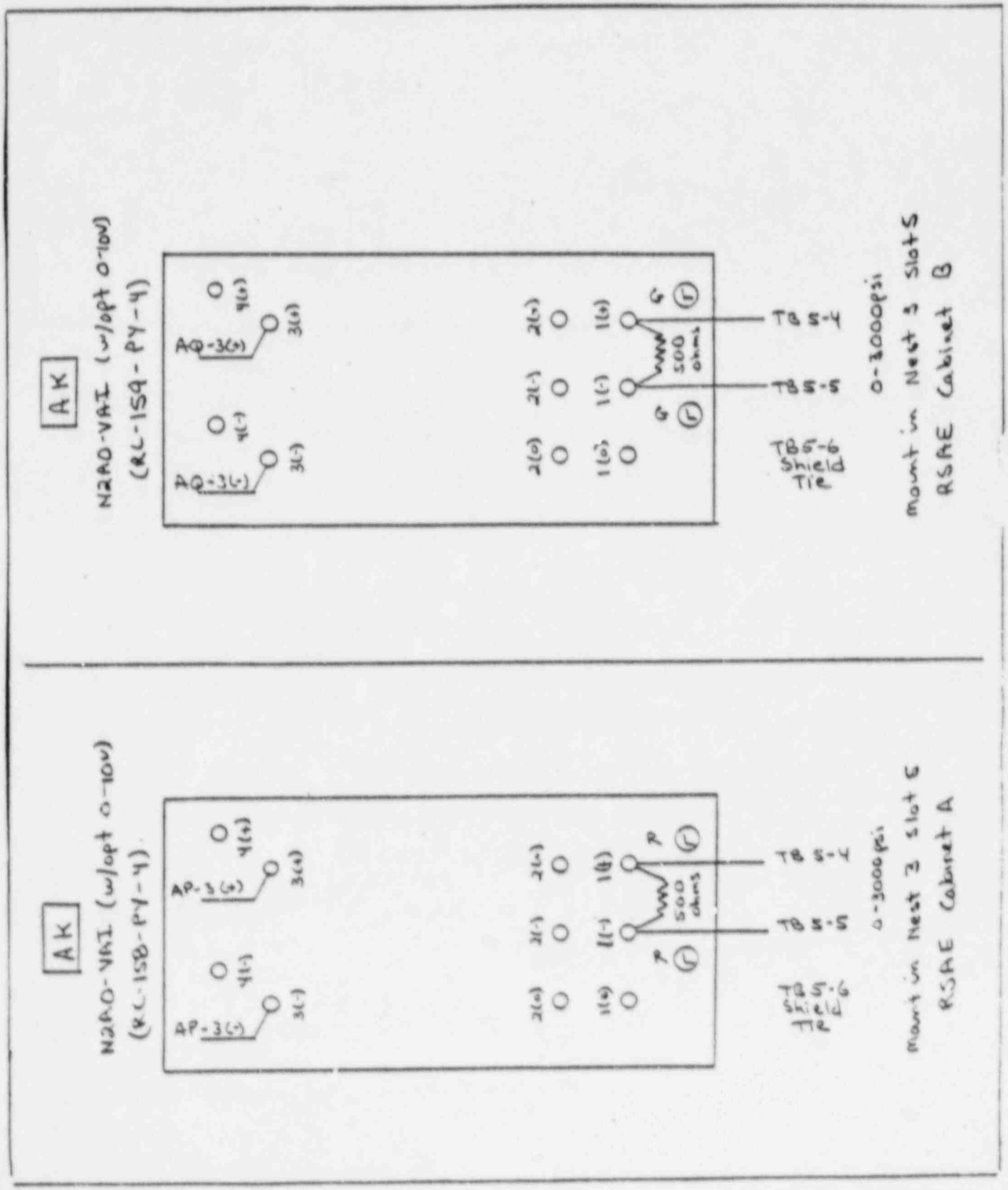
DSS One Line - NNI X (NNI Y Similar)



ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 4 of 12

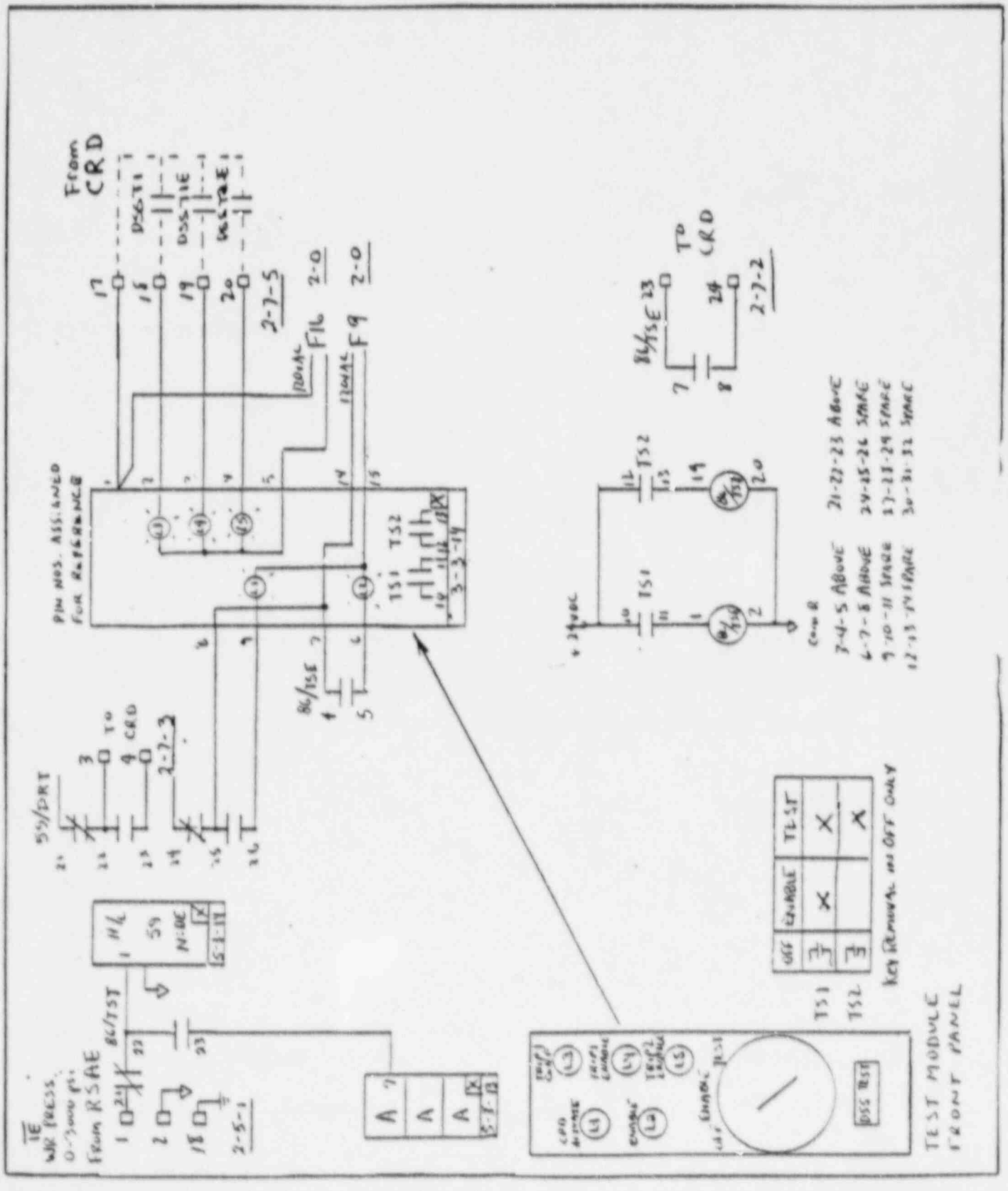
DSS - RSAE A & B Schematic



ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 5 of 12

DSS - NNI-X Schematic

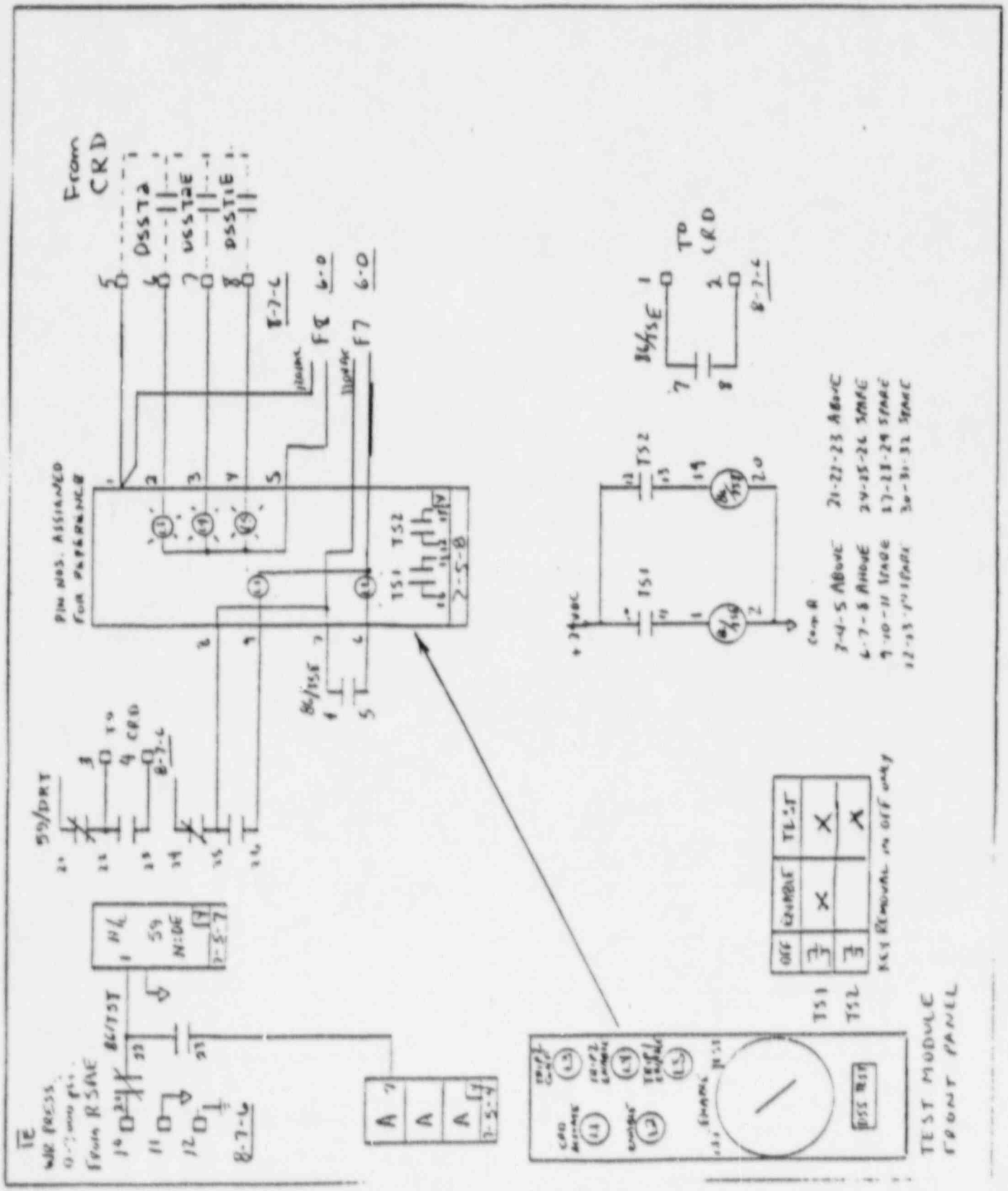


IDENT	P_{wr}	LOCATION	SERVICE	SPARE CONT. OR COIL DUTY	
59/DRT	X	5-3-14	(E) RC WIDE RANGE PRESS. GREATER THAN_	—	
86/TSE	X	5-3-15	(E) ENABLE CRD TEST and Interlock	2 FORM C	
86/TST	X	5-3-15	(E) SELECT CRD TEST, permits testing	3 FORM C	
TS1	X	3-3-14	CLOSE-ENABLE 86/TSC	—	
TS2	X	3-3-14	CLOSE-ENABLE 86/TST	—	
DSSTI	X	EXTERNAL	BY OTHERS- CLOSE INDICATE TRIP1 CONF.	—	
DSSTIE	X	EXTERNAL	" " " " TRIP1 ENABLE	—	
DSSTZE	X	EXTERNAL	" " " " TRIP 2 ENABLE	—	

ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 7 of 12

DSS - NNI-Y Schematic



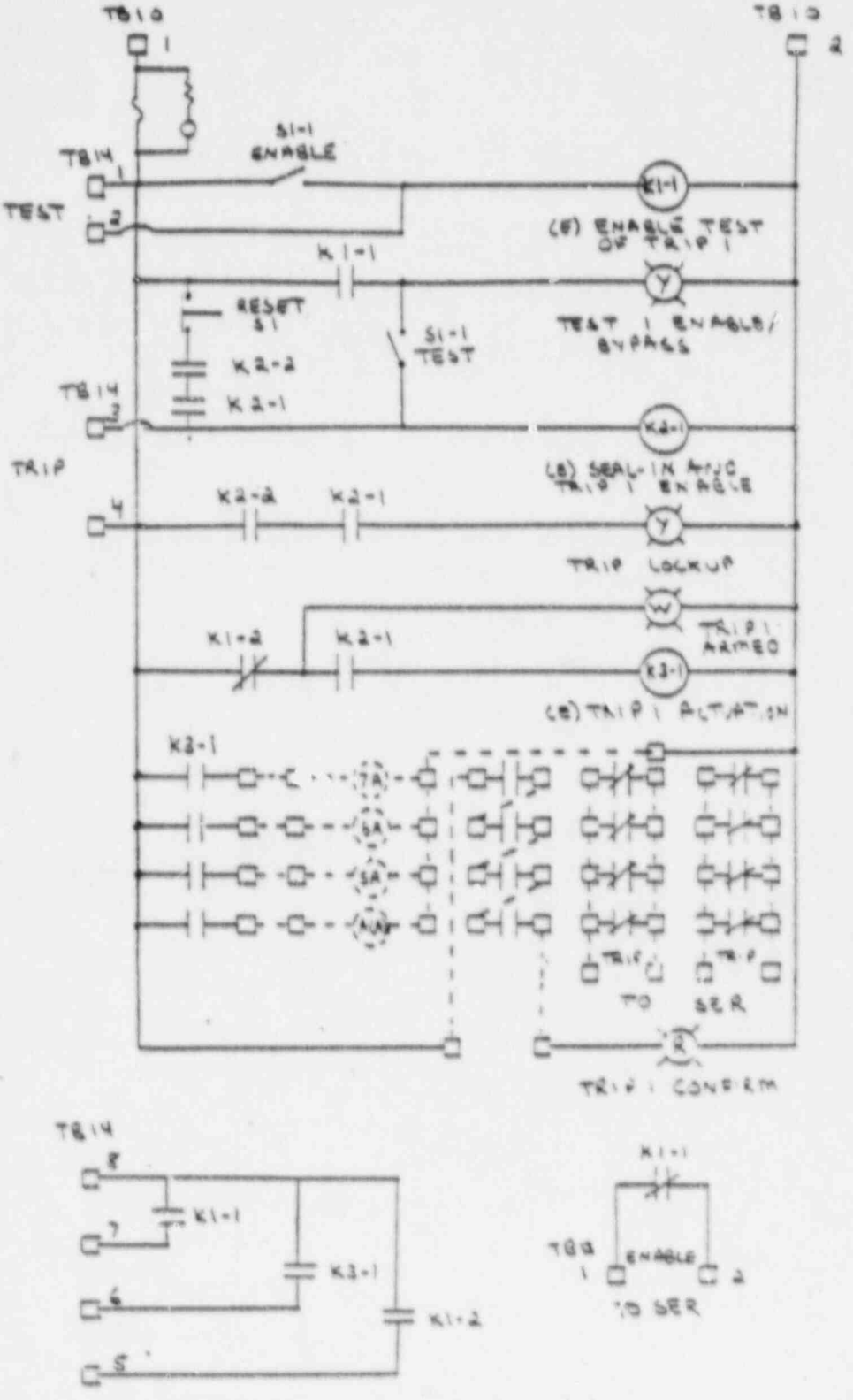
ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 8 of 12

DSS - NNI-Y Schematic Cont'd

IDENT	P_{w_F}	LOCATION	SERVICE	SPARE CONT. OR COIL DWG	
59/DRT	Y	7-5-7	(E) RC WIDE RANGE PRESS. GREATER THAN __	—	
86/TSE	Y	7-3-13	(E) ENABLE CRD TEST, and Interlocks	2 FORM C	
86/TST	Y	7-3-13	(E) SELECT CRD TEST, permits testing	3 FORM C	
TS1	Y	7-5-8	CLOSE-ENABLE 86/TSC	—	
TS2	Y	7-6-8	CLOSE-ENABLE 86/TST	—	
DSST2	Y	EXTERNAL	BY OTHERS - CLOSE INDICATE TRIP 2 CONF.	—	
DSST2E	Y	EXTERNAL	" " " " TRIP 2 ENABLE	—	
DSST1E	Y	EXTERNAL	" " " " TRIP 1 ENABLE	—	

DSS - CRDCS DC HOLD SUPPLY CABINET A SCHEMATIC TRIP 1

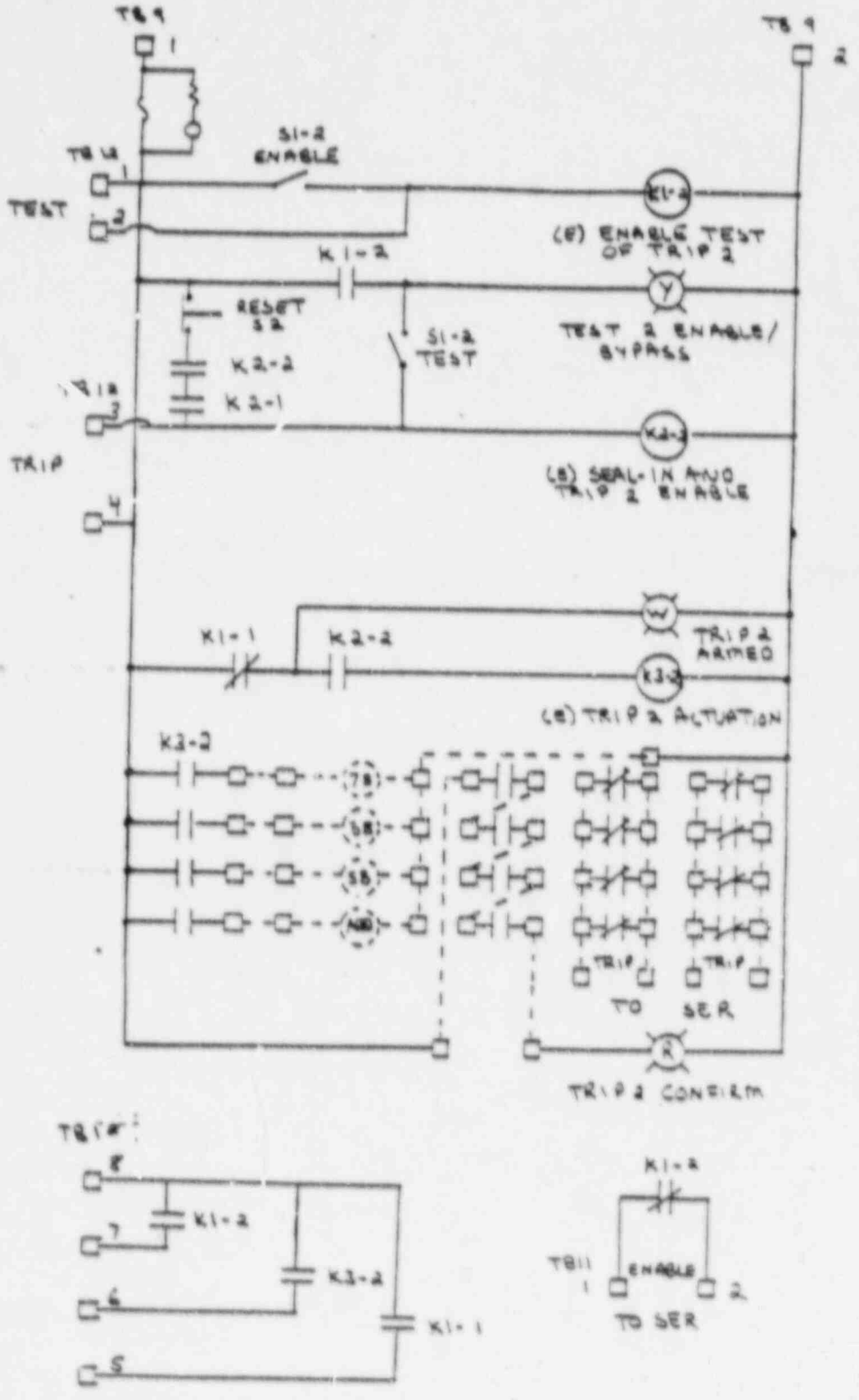


TB14 GOES TO NNI-X ---- SCR POWER SUPPLY INVC CABINET ROW 4 PINS

ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 10 of 12

DSS - CRDCS DC HOLD SUPPLY CABINET A SCHEMATIC TRIP 2

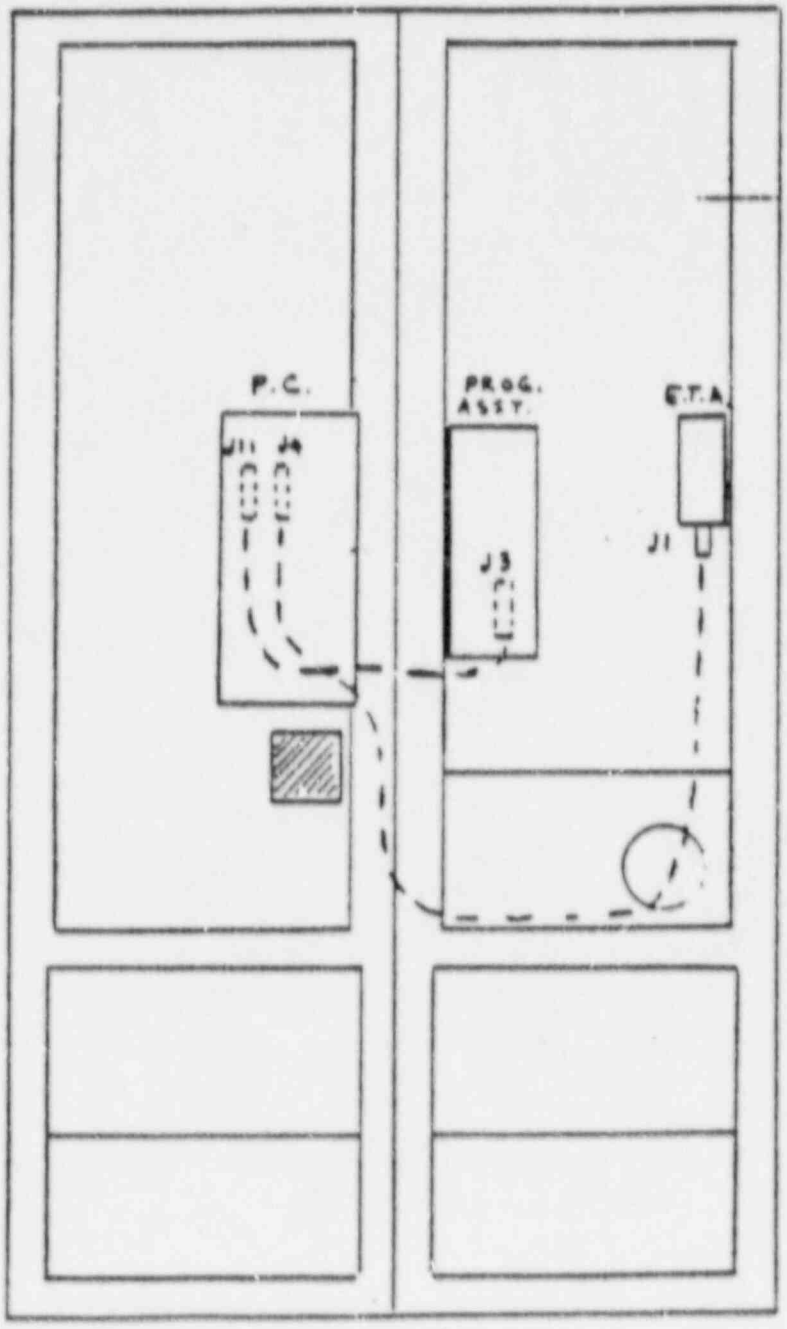


TB12 6065 TO NNI-Y ---- SCR POWER SUPPLY AND CABINET ROW WIRING

ATWS CONCEPTUAL DESIGN

Attachment 4
Sheet 11 of 12

DSS TRIP BOX LOCATION



SCR POWER SUPPY CABINETS

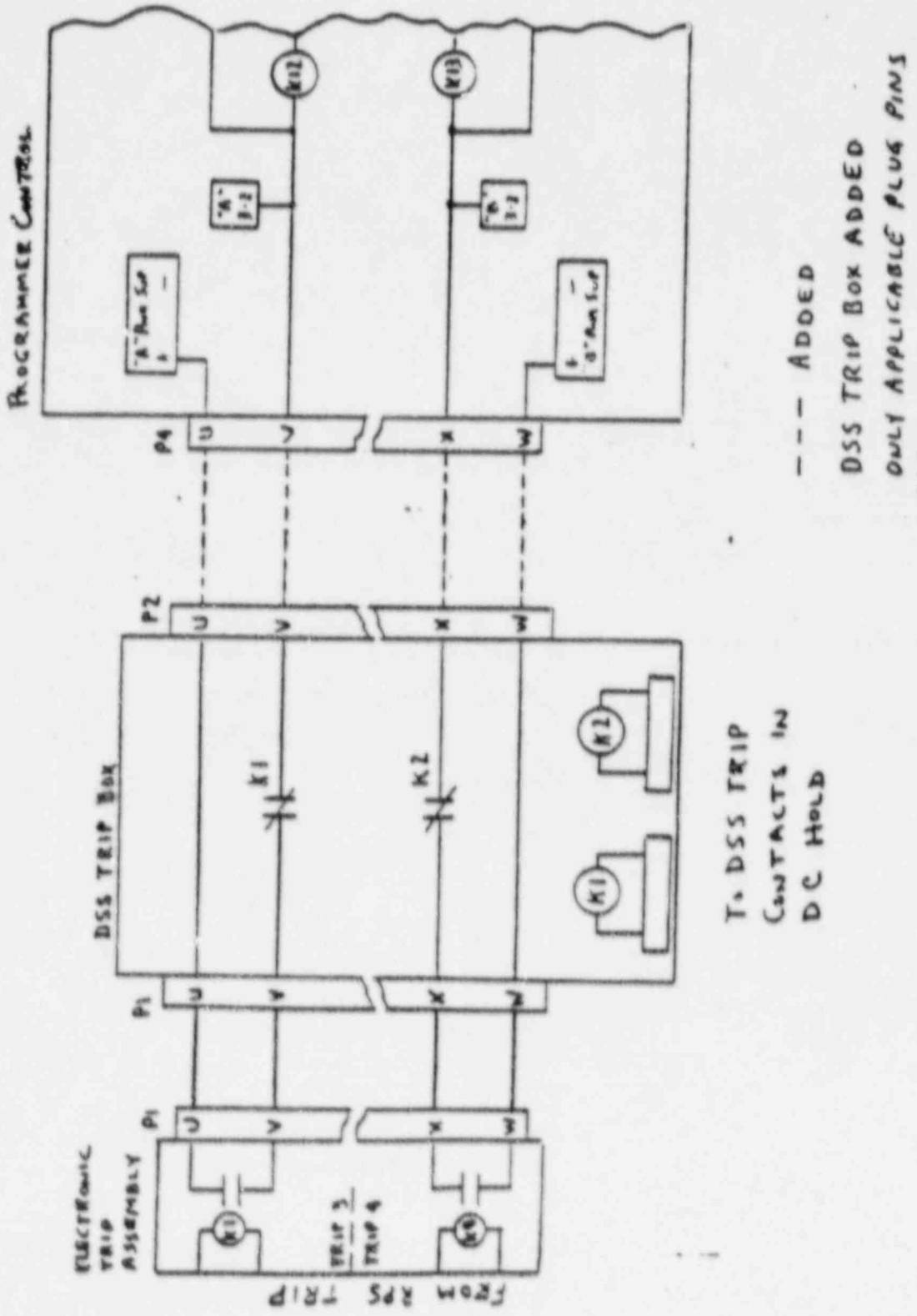
DSS TRIP BOX LOCATION

— — — EXISTING CABLING

ATWS CONCEPTUAL DESIGN

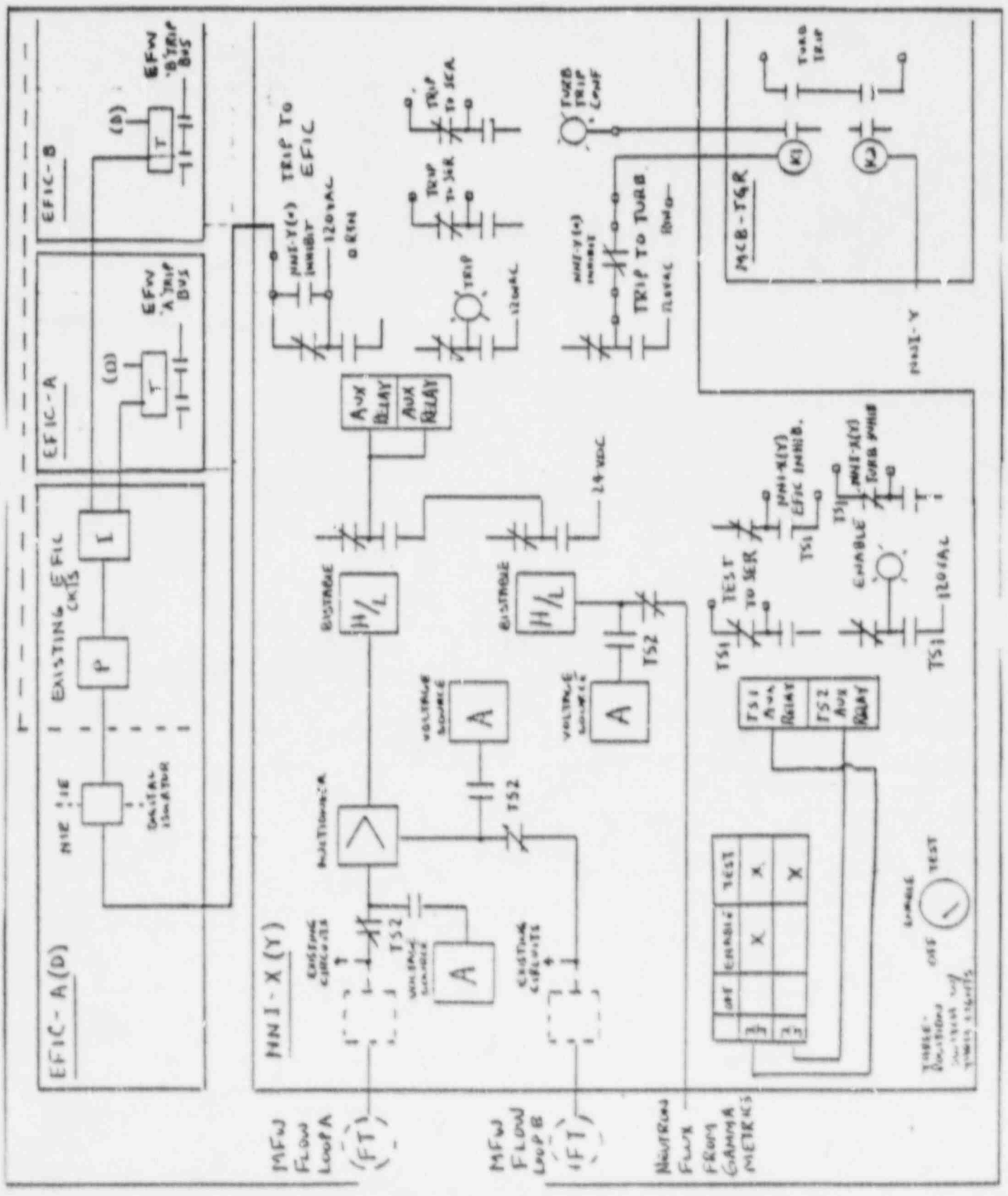
Attachment 4
Sheet 12 of 12

DSS TRIP CONTACT LOCATION



ATWS CONCEPTUAL DESIGN

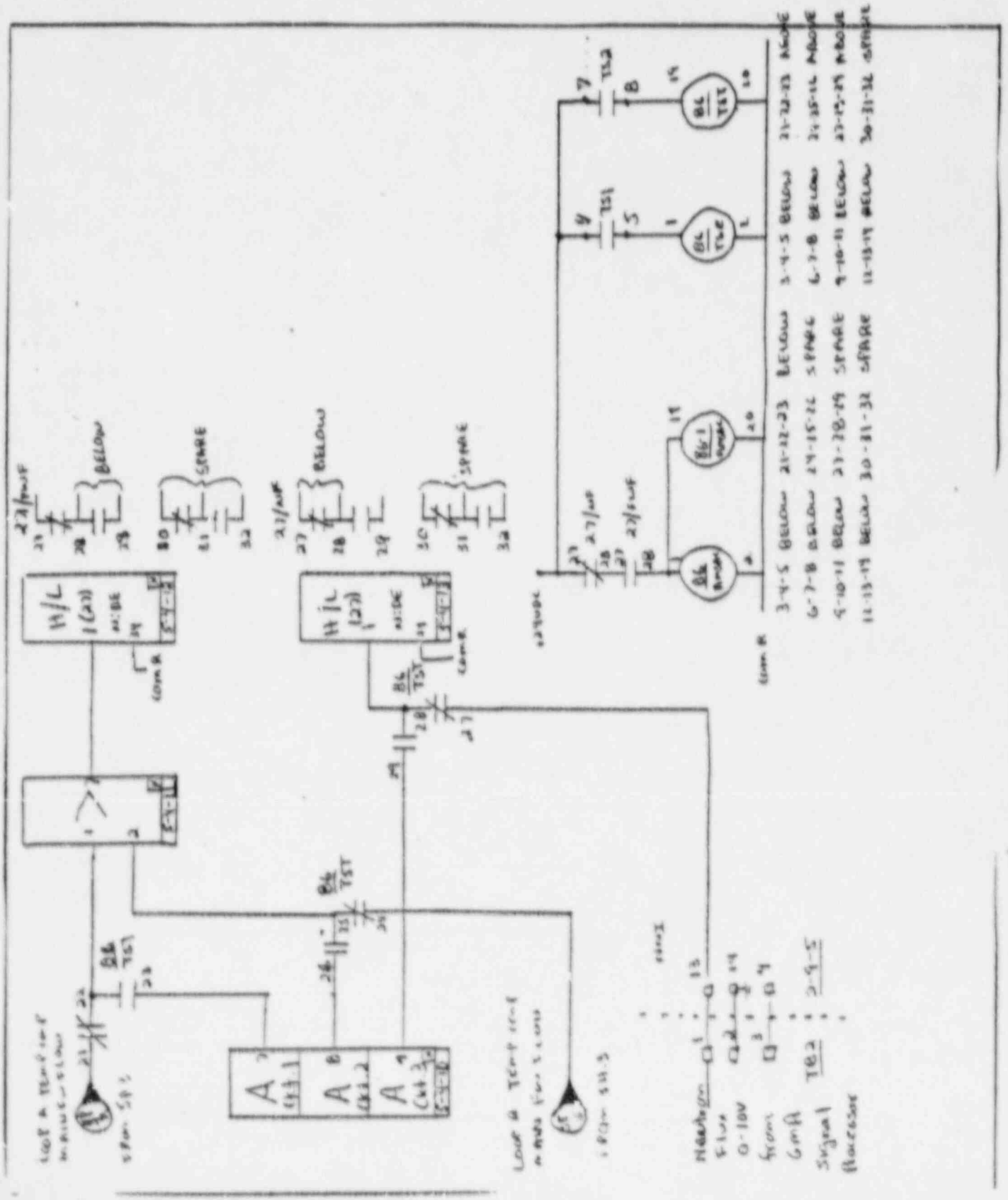
Attachment 5
Sheet 1 of 7
AMSAC - One Line



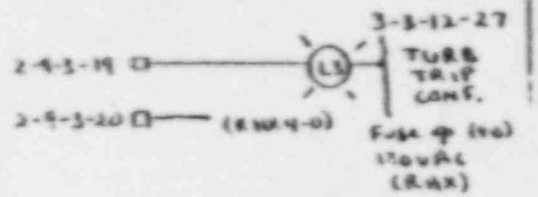
ATWS CONCEPTUAL DESIGN

Attachment 5
Sheet 2 of 7

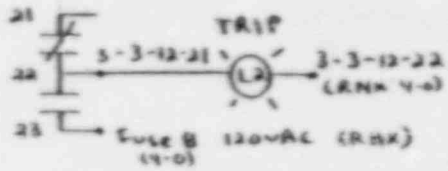
AMSAC - NNI X Schematic



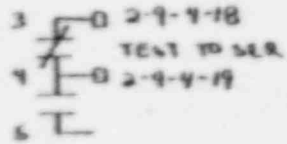
ENDENT	P.	LOCATION	SERVICE	SPARE CONT OR SOLID STATE
27/FWF	X	5-4-12	(E) Feedwater flow in Loop A and B less than %	1 FORM C
27/NF	X	5-4-13	(E) Neutron flux less than 25%	1 FORM C
86/AMSAC	X	5-4-14	(E) Feedwater flow in Loop A and B less than % and neutron flux greater than 25%.	—
86-1/AMSAC	X	5-4-14	Same as 86/AMSAC	3 FORM C
86/TSE	X	5-4-15	(E) Test switch in enable position	—
86/TST	X	5-4-15	(E) Test switch in test position	1 FORM C
TS1	X	3-3-12	(E) Test switch in enable position	—
TS2	X	3-3-12	(E) Test switch in test position	—



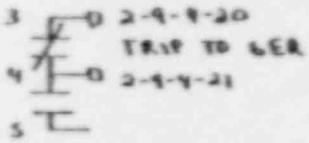
86-1/AMSAC (from above)

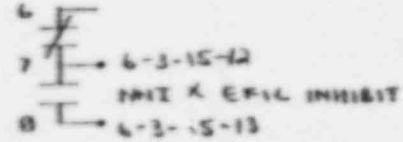


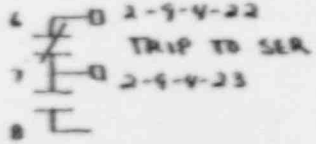
86/TSE (from above)

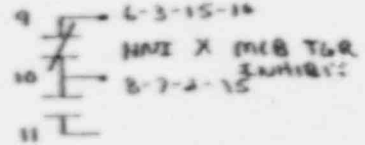


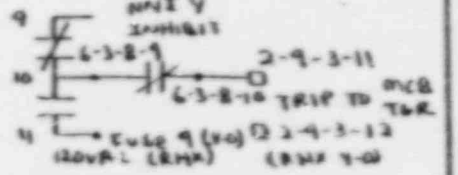
86/AMSAC (from above)

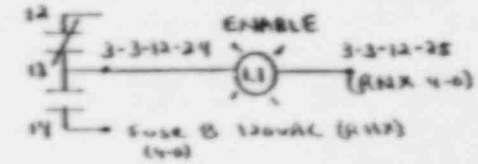


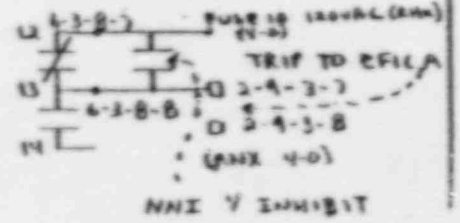


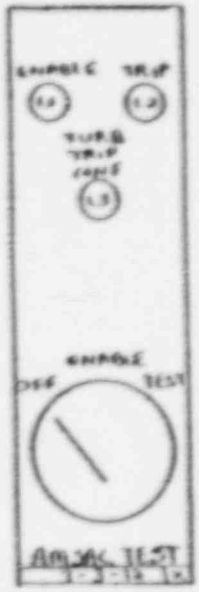












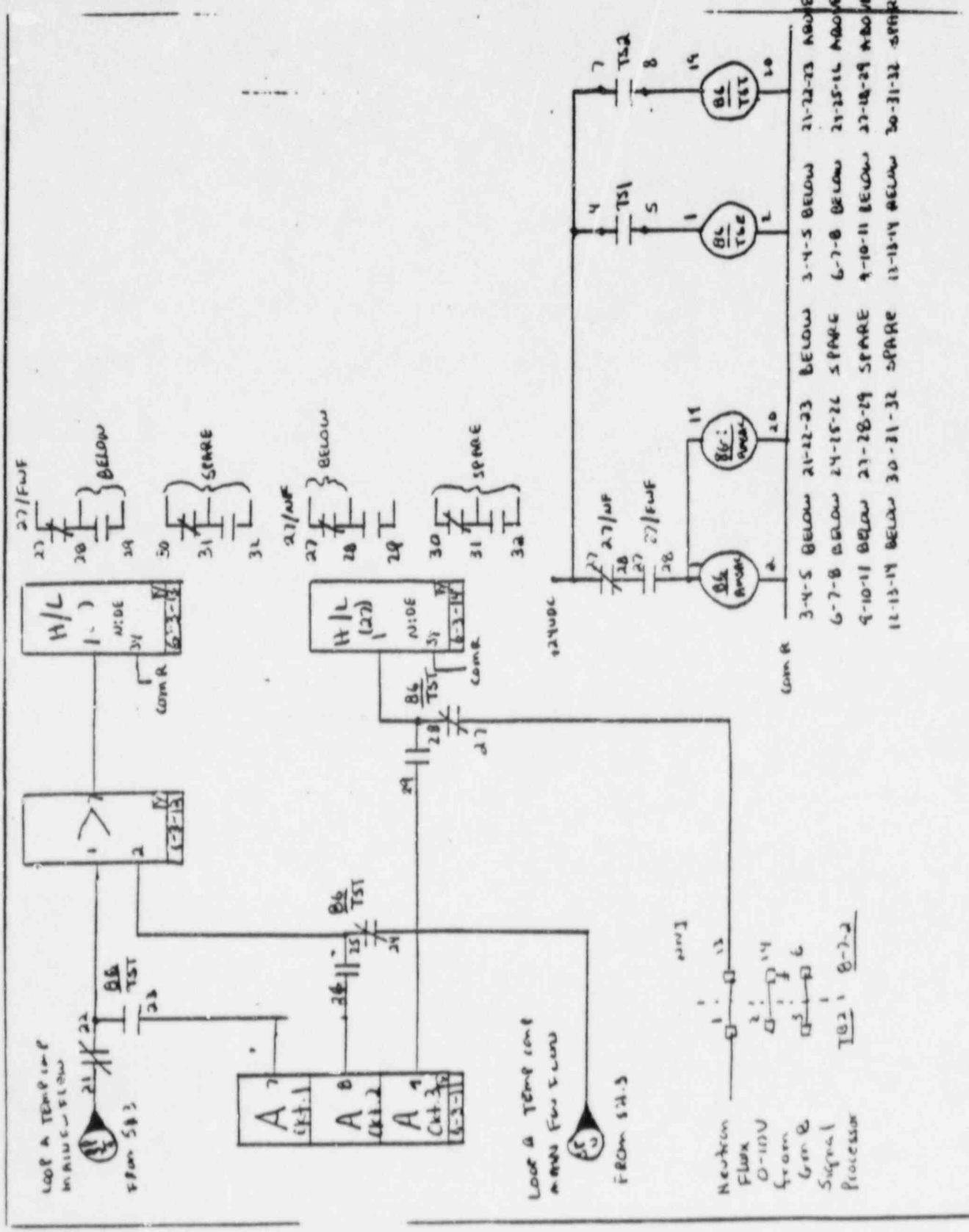
TEST MODULE FRONT PANEL

	OFF	ENABLE	TEST
TS1	3 4 5	X	X
TS2	6 7 8		X

ATWS CONCEPTUAL DESIGN

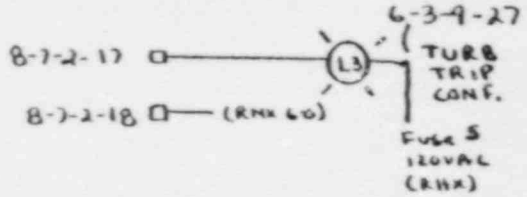
Attachment 5
Sheet 4 of 7

AMSAC - NNI Y Schematic

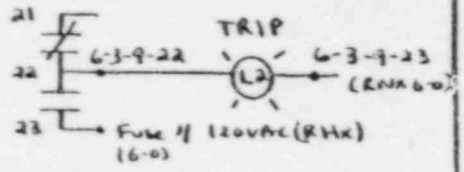


AMSAC - NNI Y Schematic Cont'd

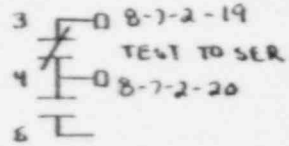
ENDPNT	P.A.	LOCATION	SERVICE	SPARE CONT. FOR SOLS PLUG.
27/FWF	Y	6-3-13	(E) Feedwater flow in Loop A and B less than %	1 FORM C
27/NF	Y	6-3-14	(E) Neutron flux less than 25%	1 FORM C
86/AMSAC	Y	6-3-15	(E) Feedwater flow in Loop A and B less than % and neutron flux greater than 25%.	——
86-1/AMSAC	Y	6-3-15	Same as 86/AMSAC	3 FORM C
86/TSE	Y	6-3-8	(E) Test switch in enable position	——
86/TST	Y	6-3-8	(E) Test switch in test position	1 FORM C
TS1	Y	6-3-9	(E) Test switch in enable position	——
TS2	Y	6-3-9	(E) Test switch in test position	——



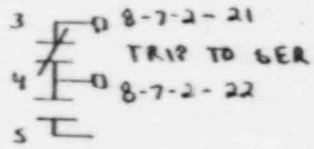
86-1/AMSAC (from above)

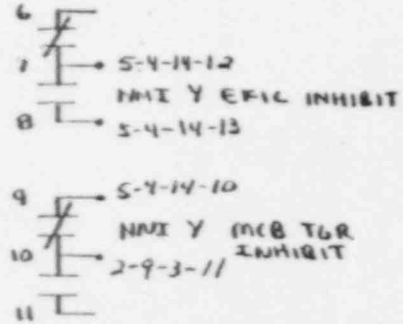


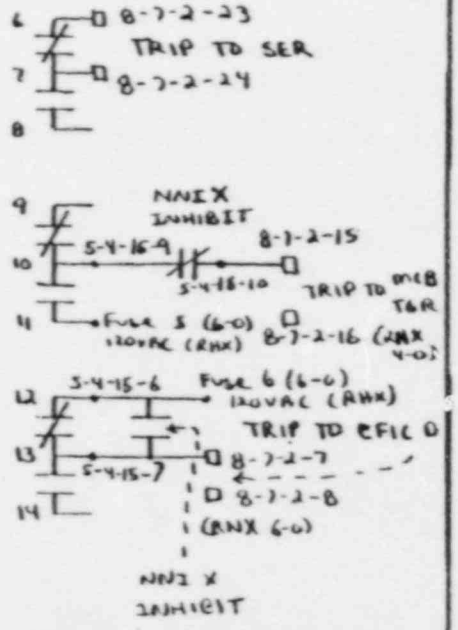
86/TSE (from above)

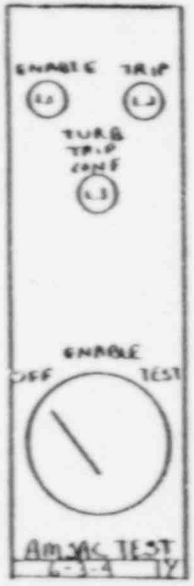


86/AMSAC (from above)









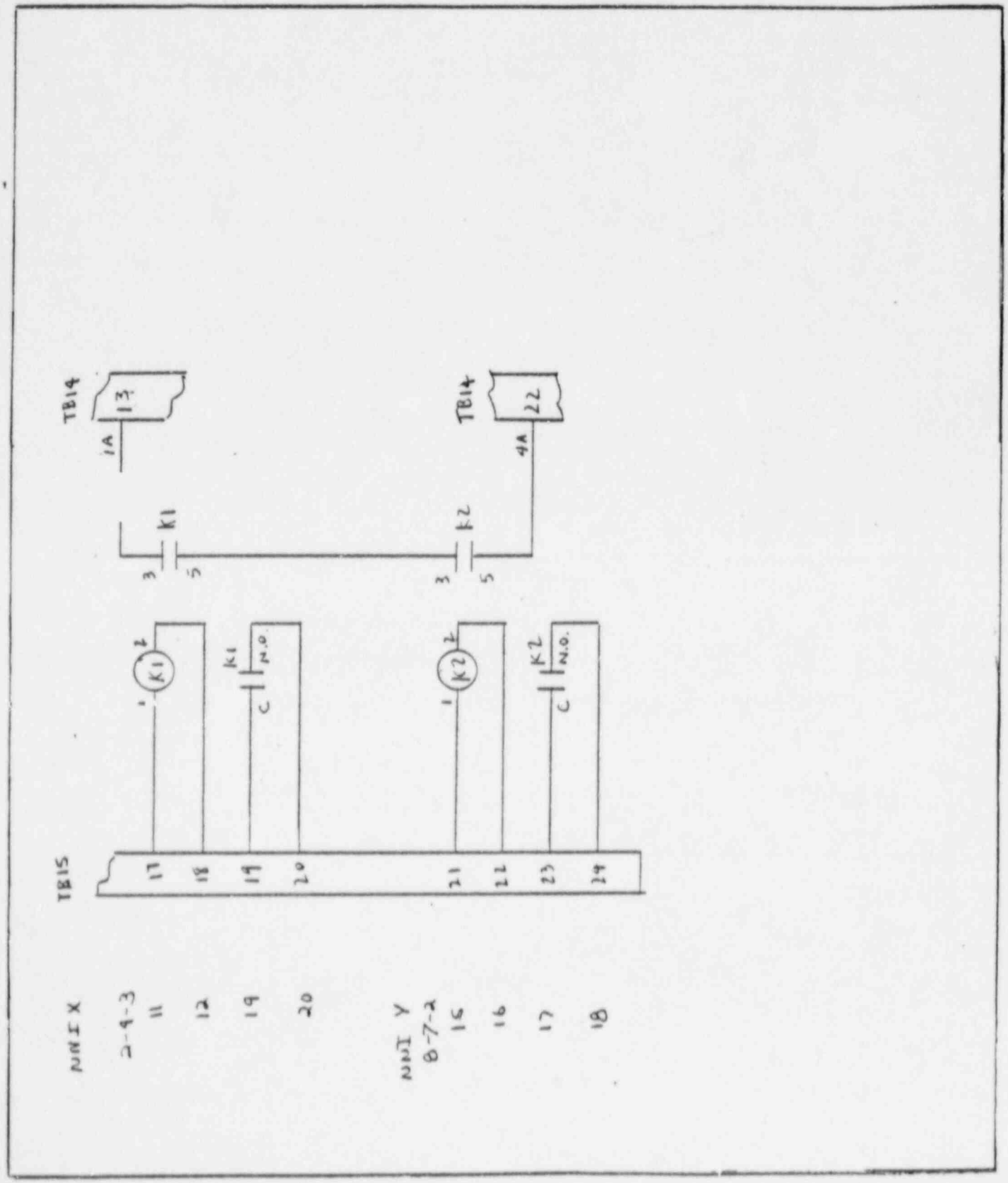
TEST MODULE FRONT PANEL

	OFF	ENABLE	TEST
TS1		X	X
TS2			X

ATWS CONCEPTUAL DESIGN

Attachment 5
Sheet 6 of 7

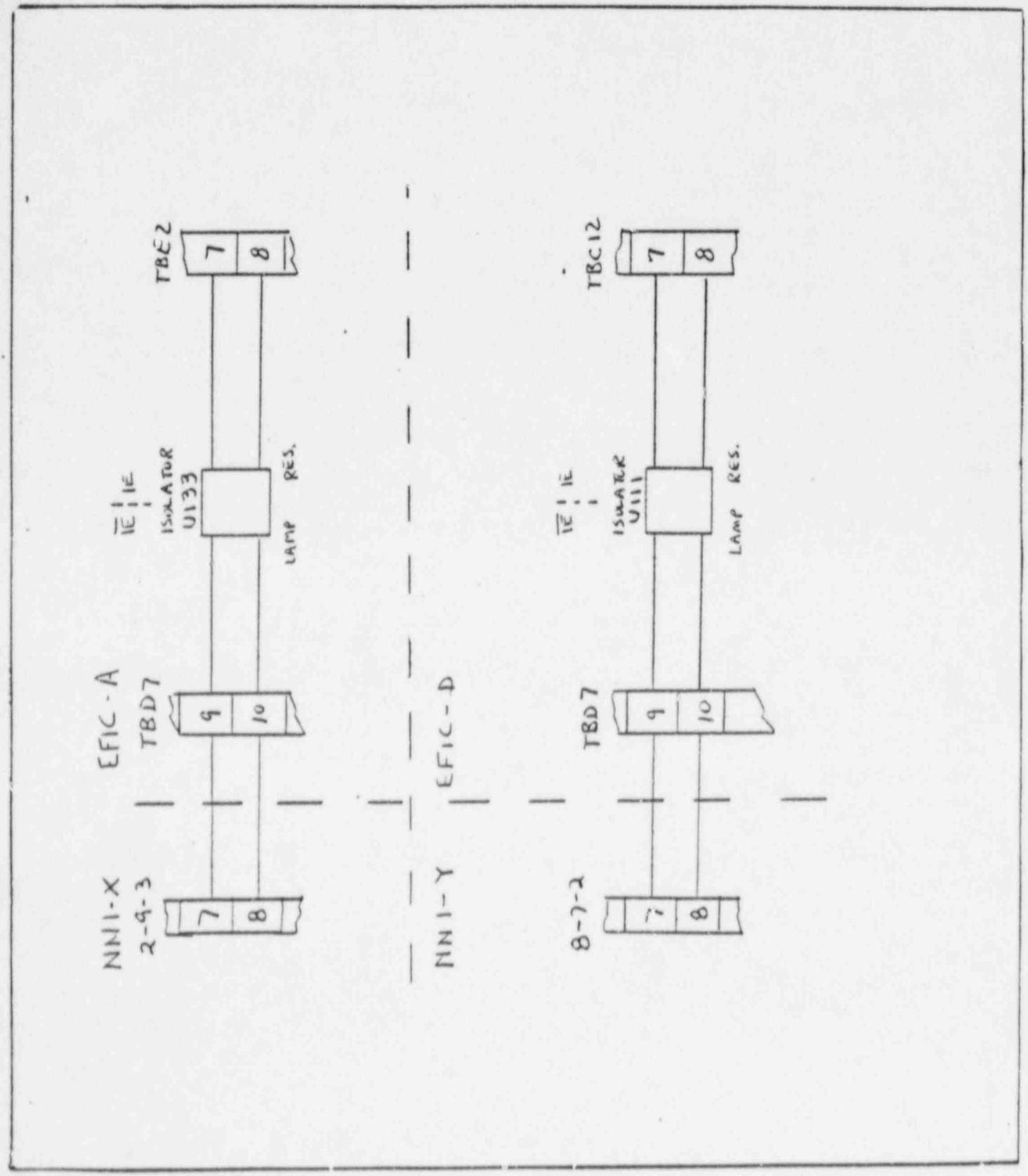
AMSAC - TGR Schematic



ATWS CONCEPTUAL DESIGN

Attachment 5
Sheet 7 of 7

AMSAC - EFIC Schematic



Florida Power

BILL OF MATERIAL

BILL OF MATERIAL # _____ REV. _____ SHEET 1 OF 5

MAR. NO. 84-06-07-01 FCN NO. _____ FCR NO. _____ WORK REQUEST NO. _____ DATE REQUIRED _____

ITEM NUMBER	SAFETY CLASS	ITEM DESCRIPTION (INCLUDE DESIGN CODE / CLASS)	QUANTITY U / I	RECMD. STOCK Y / N	RECMD. STOCK QTY	DATE REQUIRED	MMIS / REEQUISITION NUMBER (P.R. / MMIS # / NPA)
1	NS	Triple DC Signal Generator Bailey P/N 6623835-3	4ea	N/A			63705114
2	NS	Signal Monitor Bailey P/N 6623819-1	6ea	N/A			63705687
3	NS	24VDC Auxiliary Relay Bailey P/N 6624913-1	6ea	N/A			52600057
4	NS	Two Input Auctioneer Bailey P/N 6624523-1	2ea	N/A			63705316
5	NS	Three Position Test Switch Grayhill P/N 44LA5-03-2-3S	4ea				PR (Grayhill)
6	NS	Test Lamp, Neon Cartridge, Red Dialight Corp. 507-4537-0931-673	10ea				PR (Dialight)
7	NS	Test Lamp, Neon Cartridge, Yellow Dialight Corp. 507-4537-0936-673	11ea				PR (Dialight)
8	NS	Test Lamp, Neon Cartridge, White Dialight Corp. 507-4537-0935-673	10ea				PR (Dialight)
9	NS	Lamp Holder Dialight Corp. 250-7445-14-504	31ea				PR (Dialight)

FPC ENGINEER (PM) R. H. Low
PHONE (813) 866-5325
DATE _____

ORIGINATOR P. V. Liddle
PHONE (601) 385-2103
DATE 10/28/86

STP _____
SITE _____
CONSTR _____

MATERIALS _____
PHONE _____
DATE RETURNED _____

11-85

ATWS CONCEPTUAL DESIGN - ATTACHMENT 6

Florida Power

BILL OF MATERIAL

BILL OF MATERIAL # _____ REV. _____ SHEET 2 OF 5

MAR. NO. 84-06-07-01 FCN NO. _____ FCR NO. _____ WORK REQUEST NO. _____ DATE REQUIRED _____

ITEM NUMBER	SAFETY CLASS	ITEM DESCRIPTION (INCLUDE DESIGN CODE / CLASS)	QUANTITY U / I	RECMD. STOCK Y / N	RECMD. STOCK QTY	DATE REQUIRED	MMIS / REEQUISITION NUMBER (P.R. / MMIS # / NPA)
10	NS	Relay, P&B PRDA11AJA	2ea				PR (Potter & Brumfield)
11	NS	Relay, Clark 5U12-76	2ea	N/A			62840709
12	NS	Relay, Clark 5U8-76	4ea	N/A			62840693
13	NS	Pushbutton, Momentary (N.C.), Grayhill P/N 10-101	2ea				PR (Grayhill)
14	NS	Fuseholder, Indicating, Bussman HKL-X	2ea	N/A			01265683
15	NS	Fuse, Slo Blo, Bussman MDX-5	2ea	N/A			01280409
16	NS	Terminal Block, Kulka 602-JJ-10-F	6ea	N/A			65230743
17	S	Voltage to Voltage Isolator Foxboro #N-2AO-VAI w/opt 0-10VDC	2ea	N/A			52601302
18	S	EFIC Digital Isolator, 120 VAC Vitro #0423-2645-4	2ea	N/A			52601210
19	S	Misc. EFIC Wire & Acces.					
		I/C cable, 22AWG Mil-W-22759	200ft				PR (Vitro)
		Wire Lug, T&B RAT-853 or equal	4				
		Wire Lug, T&B RAT-863 or equal	4				
		Wire Sleeve, .065 I.D.	5ft				

FPC ENGINEER (PM) R.H. Low
PHONE (813) 866-5325
DATE _____

ORIGINATOR L.V. Liddle
PHONE (804) 385-2103
DATE 10/28/86

STP _____
SITE _____
CONSTR _____

MATERIALS _____
PHONE _____
DATE RETURNED _____

ATWS CONCEPTUAL DESIGN - ATTACHMENT 6

Florida Power

BILL OF MATERIAL

BILL OF MATERIAL # _____ REV. _____ SHEET 3 OF 5

MAR. NO. 84-06-C7-01 FCN NO. _____ FCR NO. _____ WORK REQUEST NO. _____ DATE REQUIRED _____

ITEM NUMBER	SAFETY CLASS	ITEM DESCRIPTION (INCLUDE DESIGN CODE / CLASS)	QUANTITY U/I	RECMD. STOCK Y/N	RECMD. STOCK QTY	DATE REQUIRED	MMIS / REEQUISITION NUMBER (P.R. / MMIS # / NPA)
20	NS	Module Frame Bailey P/N 6629506-1	4ea				PR (Bailey)
21	NS	Module Connector, 36 pin Bailey P/N 1945304-2 (Elco)	2ea				PR (Bailey)
22	NS	Fastener Stud Bailey P/N 197285-1	8ea				PR (Bailey)
23	NS	Brg, Washer Bailey P/N 197296-8	8ea				PR (Bailey)
24	NS	Retaining Ring Bailey P/N 197301-18	8ea				PR (Bailey)
25	NS	Cable Clip Bailey P/N 1943187-6	8ea				PR (Bailey)
26	NS	Module Receptacle, 32 pin Bailey P/N 69035-1 (Blue Ribbon)	2ea				PR (Bailey)
27	NS	Module Connector, 32 pin Bailey P/N 691371-1 (Blue Ribbon)	2ea				PR (Bailey)
28	NS	0.112-40x0.25 LG CD PL.STL PAN HD SEMS. EXT	4ea				PR (Bailey)

FPC ENGINEER (PM) R.H. Low
PHONE (813) 866-5325
DATE _____

ORIGINATOR L.V. Riddle
PHONE (804) 385-2103
DATE 10/28/86

STP _____
SITE _____
CONSTR _____

MATERIALS _____
PHONE _____
DATE RETURNED _____

ATWS CONCEPTUAL DESIGN - ATTACHMENT 6

Florida Power

BILL OF MATERIAL

BILL OF MATERIAL # _____ REV. _____ SHEET 4 OF 5

MAR. NO. 84-06-07-01 FCN NO. _____ FCR NO. _____ WORK REQUEST NO. _____ DATE REQUIRED _____

ITEM NUMBER	SAFETY CLASS	ITEM DESCRIPTION (INCLUDE DESIGN CODE / CLASS)	QUANTITY U / I	RECMD. STOCK Y / N	RECMD. STOCK QTY	DATE REQUIRED	MMIS / REEQUISITION NUMBER (P.R. / MMIS # / NPA)
29	NS	Screw, Mach 2-56x1/2" Flat Head CAD, PLT, STL	4ea				PR (Local)
30	NS	Lockwasher Int. #2 ID, CAD PLT STL	4ea				PR (Local)
31	NS	Hex Nut, 2-56, CAD PLT, STL	4ea				PR (Local)
32	NS	Cable Clip Hardware					
		10-32x1/2" CAD SS FLT HD	8ea				01710491
		10-32 STL Hex Nut	8ea				01150512
		#10 Plain Washer	8ea				01150010
33	NS	Cable EK-18W, I/C 14 AWG. BLK	400ft	N/A			01270419
34	NS	Wire Lug, Burndy YAE 12-N	100ea	N/A			01267852
35	NS	Wire Sleeve	20 ft				
36	NS	Wire, 22 Solid Mil-W-76B, BLK	2000ft	N/A			01270329
37	S	Wire I/C, 14 AWG,SIS, Red	30ft	N/A			01270360
38	S	Wire, I/C, 14 AWG, SIS, GRN	30ft	N/A			01270361
39	S	Wire Lug, #20-14, 6-8 Stud	1box	N/A			01267874

FPC ENGINEER (PM) R.H. Low
PHONE (813) 866-5325
DATE _____

ORIGINATOR P.V. Riddle
PHONE (804) 385-2103
DATE 10/26/84

STP _____
SITE _____
CONSTR _____

MATERIALS _____
PHONE _____
DATE RETURNED _____

ATWS CONCEPTUAL DESIGN - ATTACHMENT 6

11-85

RFT Out1 RESP: Nuclear Engineering

BILL OF MATERIAL

BILL OF MATERIAL # _____ REV. _____ SHEET 5 OF 5

MAR. NO. 84-06-07-01 FCN NO. _____ WORK REQUEST NO. _____ DATE REQUIRED _____

ITEM NUMBER	SAFETY CLASS	ITEM DESCRIPTION (INCLUDE DESIGN CODE / CLASS)	QUANTITY U / I	RECMD. STOCK Y / N	RECMD. STOCK QTY	DATE REQUIRED	MMIS / REQUISITION NUMBER (P.R. / MMIS # / NPA)
40	NS	Cable, EK-35A, 2/C, 14 AWG. BLK	2500'	N/A			01270427
41	NS	Cable, EK-18E, 5/C, 14 AWG, BLK	400'	N/A			01270417
42	NS	Cable, EK-18J, 9/C, 14 AWG, BLK	435'	N/A			01270396
43	NS	1-1/2" Conduit & Assoc. Fittings	350'				
44	NS	1" Conduit & Assoc. Fittings	600'				
45	NS	AL PNL-Approx. 10"x19"x1/8					Make from 01574117
46	NS	AL PNL-Approx. 10"x24"x1/8"					
47	NS	Relay, P&B P/N R10 E1 120VAC 27E461	8 ea				PR (Potter & Brumfield)
48	NS	Terminal Block, Kulka P/N 37TB-16	8 ea	N/A			65230754
49	NS	Huffman Box P/N A-808SC	4 ea				PR (Huffman)

FPC ENGINEER (PM) R.H. Low
PHONE (813) 866-5325
DATE _____

ORIGINATOR P.V. Liddle
PHONE (804) 385-2103
DATE 10/28/86

STP _____
SITE _____
CONSTR _____

MATERIALS _____
PHONE _____ DATE RECV'D. _____
DATE RETURNED _____

ATWS CONCEPTUAL DESIGN _ ATTACHMENT 6

ATWS CONCEPTUAL DESIGN
MODIFICATION SAFETY EVALUATION

MAR NO. ___ - 84 - 06 - 07 - 01

SAFETY EVALUATION: Answer the following questions and provide specific justification (use attachment if necessary).

1. Is the probability of an occurrence or the consequence of an accident or malfunction of equipment important to safety as previously evaluated in the Final Safety Analysis Report, INCREASED? YES ___ NO X
   Because:

See Attached Sheet

2. Is the possibility for an accident or malfunction of a different type than any previously evaluated in the Final Safety Analysis Report, CREATED? YES ___ NO X
   Because:

See Attached Sheet

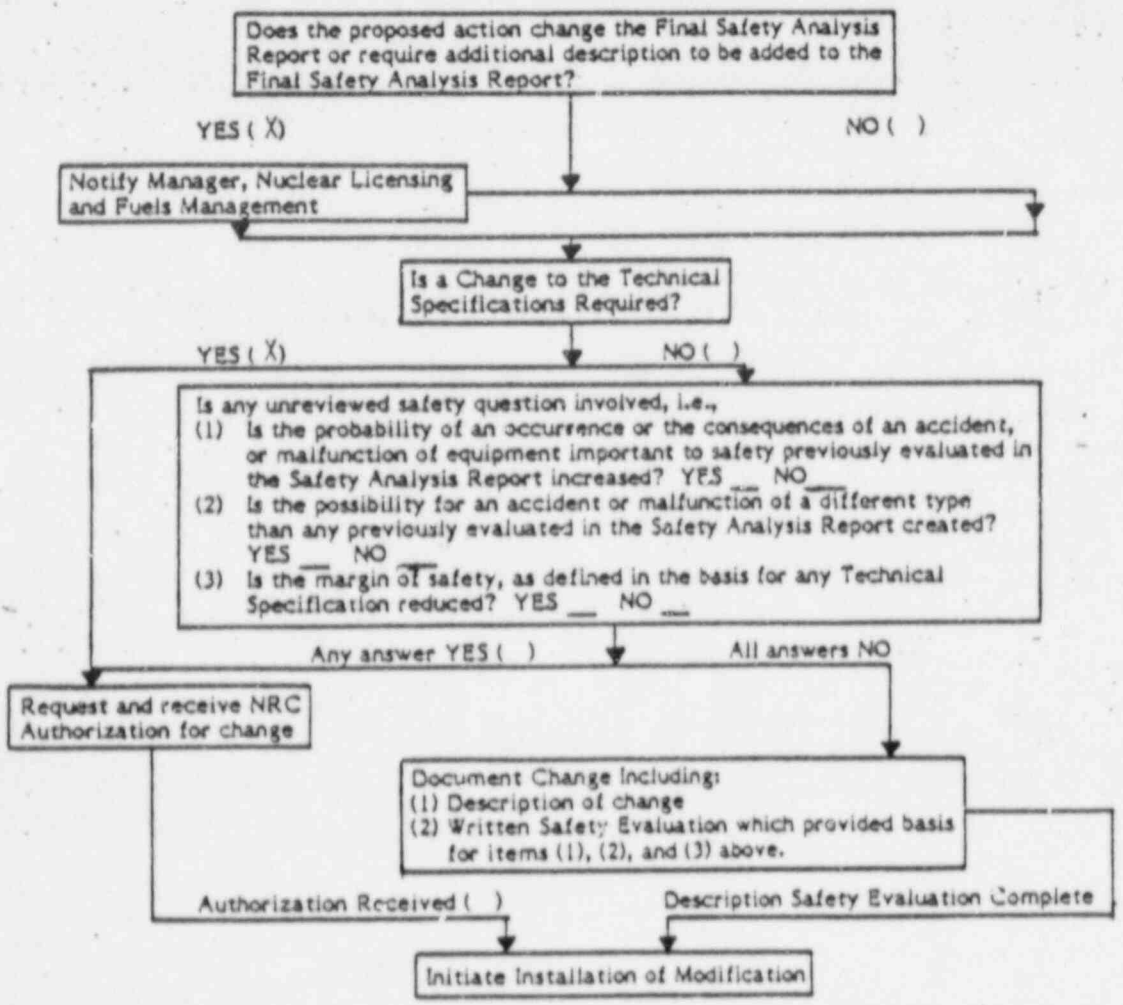
3. Is the margin of safety, as defined in the basis for any Technical Specification, REDUCED? YES ___ NO X
   Because:

See Attached Sheet

LICENSE REVISION REQUIRED:

Final Safety Analysis Report:	YES X	NO ___
Technical Specification:	YES X	NO ___
NRC Authorization for Change Required:	YES X	NO ___
Semi-Annual Reporting to NRC Required:	YES X	NO ___

10CFR50.59 CHECKLIST



*Required changes to Technical Specifications should be processed in parallel to this checklist.

Prepared by L.V. Riddle 10/25/84
Name Date

ATWS CONCEPTUAL DESIGN
MODIFICATION SAFETY EVALUATION

1. No, the utilization of a DSS trip provides a diverse trip actuation to the control rod drive SCR's. The DSS is a redundant backup to the Reactor Protection System trip functions. The AMSAC provides a trip signal to the turbine and EFW initiation on a two-out-of-two trip. DSS and AMSAC are physically and electrically isolated from protection systems.

2. No, the DSS provides a backup trip function, of the RPS, to the SCR's. The AMSAC provides a trip signal to the turbine and EFW initiation. None of these are different than evaluated in the FSAR.

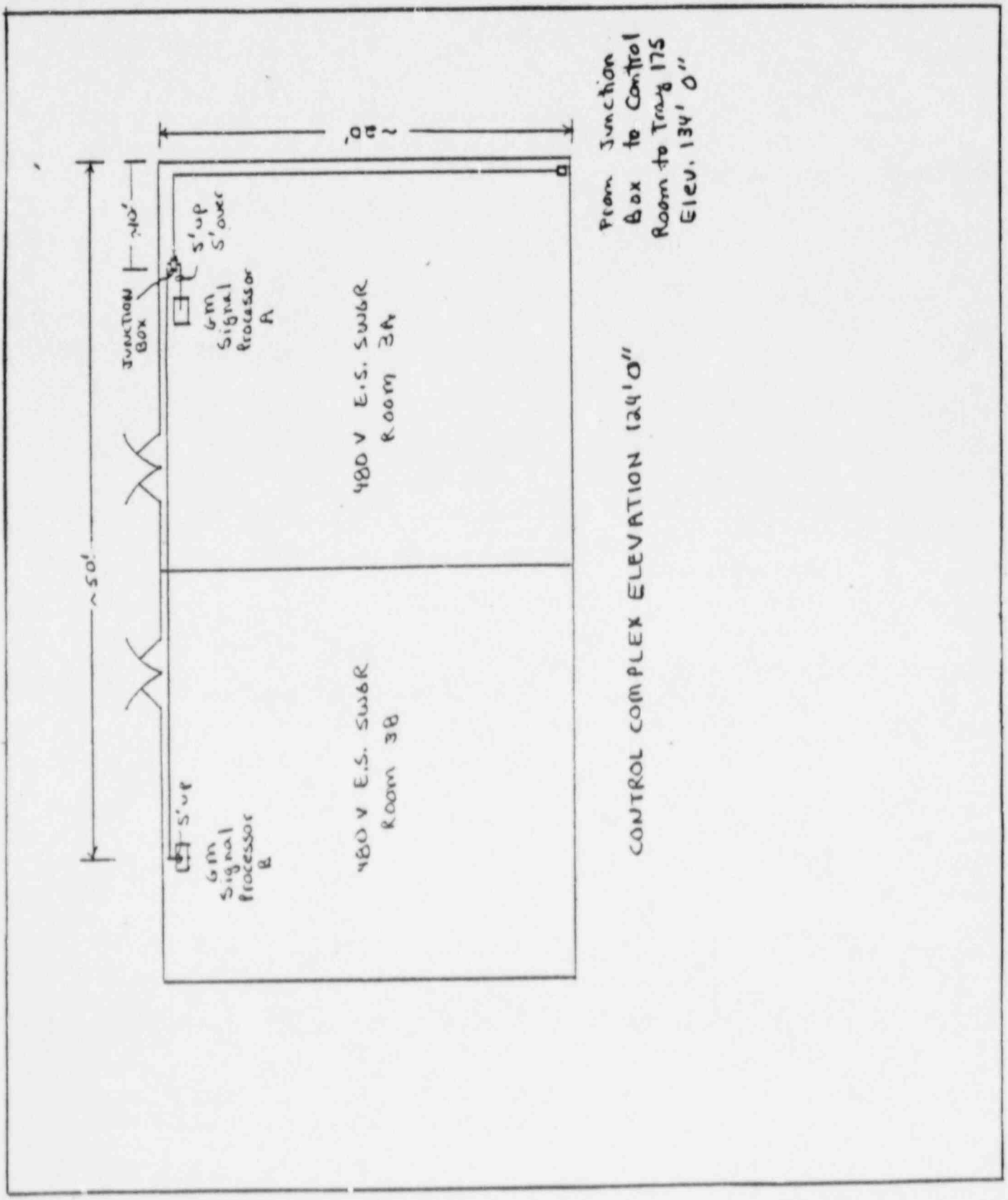
3. No, the DSS trip is a backup to the RPS trip and the AMSAC does not reduce the margin of safety as it is a mitigating system.

P V Liddle 10/28/86

ATWS CONCEPTUAL DESIGN

Attachment 8
Sheet 1 of 3

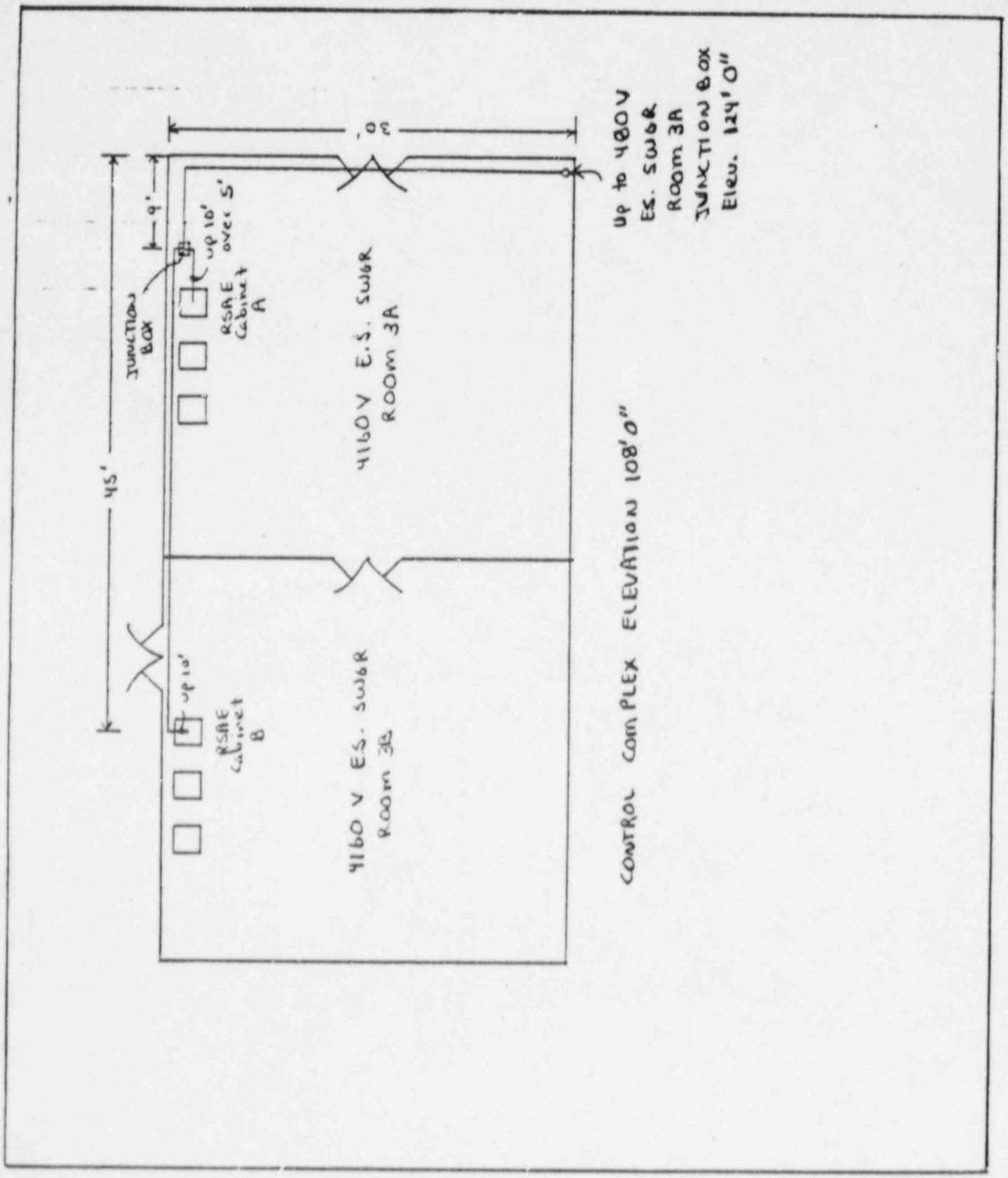
Conduit Layout



ATWS CONCEPTUAL DESIGN

Attachment 8
Sheet 2 of 3

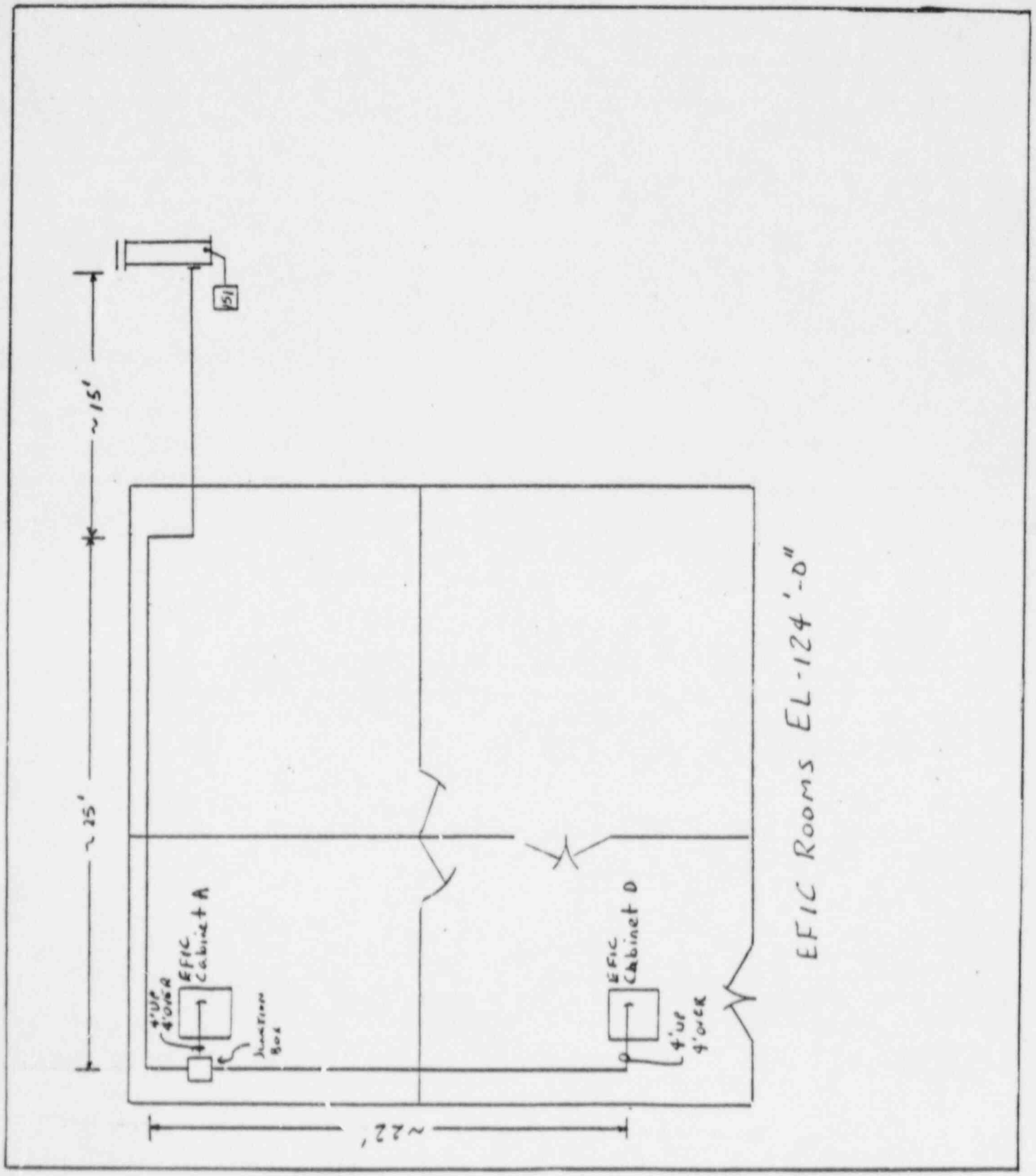
Conduit Layout



ATWS CONCEPTUAL DESIGN

Attachment 8
Sheet 3 of 3

Conduit Layout



TRIP REPORT # **DATE** 4/10/86

TRIP REPORT AUTHOR: B.J. Shepherd BJS **FILE NO.** NSS-7/T1.2

ORGANIZATION VISITED: Florida Power Corp. **COPIES**

LOCATION: Crystal River Unit 3

DATE OF TRIP: 4/3/86

PURPOSE: ATWS Conceptual Design Walkdown

PERSONNEL ATTENDING:

B&W	FPC	
B.J. Shepherd	Ron Carbiener	Paul Fleming
	Ed Good	W.A. Stephenson
	Jack Tunstill	Hugh Gelston
	R.H. Low	Ray Whittman
	Rick Currier	

The Conceptual Design Walkdown for the Diverse Scram System (DSS) and ATWS Mitigating System Actuation Circuitry (AMSAC) was conducted on April 3, 1986. The design for DSS & AMSAC was reviewed with the above personnel. During the walkdown it was determined that the NNI System drawings identified some Module spaces & terminals as spare when modules were already installed and wires existed on terminals.

Where required the location of DSS & AMSAC Modules will be changed in the Conceptual Design to unused module spaces.

For terminals shown as spare where wiring exists, it should be determined if the wiring can be removed from the system.

FPC Personnel desired to further review the DSS & AMSAC design prior to answering question numbers 16 and 17 on the walkdown check list. It is anticipated that FPC's review will be complete by 5/5/86.

The draft DSS & AMSAC Conceptual Design is being routed to FPC Personnel for comments. It is anticipated that FPC comments will be transmitted to B&W by 5/5/86. Upon receipt of comments B&W is to review and resolve the comments, revise the Conceptual Design Draft and issue the Final Conceptual Design Package.

Florida Power
CORPORATION

DESIGN WALKDOWN CHECKLIST
Crystal River Unit No. 3

MAR Number	System	Checklist Date
84-06-07-01	ATWS	4/3/86

Description	☒ Conceptual	☐ Confirmation
ATWS Conceptual Design		

PARTICIPANT'S NAME (Please Print)	FIRM & DEPARTMENT		TELEPHONE
Ron Carbiener	FPC	N.O.M.	4456
Ed Good	FPC	Nuc. Licencing	4602
Jack Tunstill	FPC	Nuc. Licencing	4691
R.H. Low	FPC	Nuc. Engineering	5325
Paul Fleming	FPC	Nuc. OPS. Trng.	795-0504(126)
W.A. Stephenson	FPC	Nuc. Plant OPS	4171
Hugh Gelston	FPC	Nuc. Plant Engr.	4397
Ray Wittman	FPC	Nuc. Plant OPS	4184
Rick Currier	FPC	N.O.M.	4406
B.J. Shepherd	B&W	Plant Engr. Services	(804)385-2777

WALKDOWN INSTRUCTIONS

1. The Design Engineer is responsible for notifying the FPC Engineering Project Manager to arrange design walkdowns.
2. The FPC Engineering Project Manager is responsible for arranging all necessary access clearances and notifying site walkdown attendees.
3. The Design Engineer is responsible for preparing the Design Walkdown Checklist (to be completed fully -N/A in advance as appropriate) and for recording walkdown observations on the Observations page.
4. Each observation should be clearly identified including location such as, building, room number, elevation, plant coordinates, etc.
5. Clarifying photographs or sketches should be utilized when appropriate.
6. Individual observations should not be lumped into single entries.
7. An appropriate contact person for follow-up should be identified.
8. The Design Engineer is responsible for the resolution of all observations.
9. Copies for earlier walkdown checklists with attachments shall be provided for subsequent walkdown reference.

WALKDOWN QUESTIONS

SECTION A

(Complete for Conceptual and Confirmation Walkdowns)

QUES. NO.	QUESTION	YES	NO	N/A	SEE OBSERVATION NUMBER
1	Are there special work area access problems? (Bulky or heavy equipment, limited access of work spaces, etc.)	☐	X	☐	
2	Do work areas require special considerations for construction, operation, or maintenance? (Respirators, temporary work enclosures, radiation access, security, special work permits or clearances.)	X	☐	☐	(1)
3	Is there need to remove temporarily grating handrails, structural steel, conduit, tubing, piping, supports, equipment, or instruments to facilitate final installation?	☐	X	☐	
4	Is there need to remove permanently grating, handrails, structural steel, conduit, tubing, piping, supports, equipment, or instruments to facilitate construction?	☐	X	☐	
5	Do design or work complexities require special installation, or testing procedures? (Special vendor installation requirements, special lifting facilities, interferences removal, etc. for maintenance.)	X	☐	☐	(2)
6	Do unrelated modifications affect the work areas creating potential interferences?	X	☐	☐	(3)
7	Will temporary shielding be required?	☐	X	☐	
8	Will permanent shielding be required?	☐	X	☐	
9	Will the design increase radiation/contamination levels?	☐	X	☐	
10	Will the design increase radiation/contamination spread?	☐	X	☐	
11	Is instrumentation/operating equipment located to minimize installation and operating personnel exposure?	X	☐	☐	(4)
12	Are alternate designs feasible to reduce potential exposure?	☐	X	☐	
13	Does the anticipated routing (conduit, tray, piping, tubing) exhibit the clearest route relative to installing supports, restraints, etc.?	X	☐	☐	(5)
14	Does the design provide for efficient maintenance of existing equipment/system?	X	☐	☐	(6)
15	Does the design provide for efficient maintenance of new equipment/system?	X	☐	☐	(7)
16	Does the design provide for efficient operation of existing equipment/system?	☐	☐	☐	(8)
17	Does the design provide for efficient operation of new equipment/system?	☐	☐	☐	(9)
18	Does the design provide for efficient testing of existing equipment/system (on line calibration of instrumentation feasible)?	X	☐	☐	(10)
19	Does the design provide for efficient testing of new equipment/system?	X	☐	☐	(11)
20	Does the design provide for efficient ISI of existing equipment/system?	☐	☐	X	
21	Does the design provide for efficient ISI of new equipment/system?	☐	☐	X	
22	Are flammable materials being added to the area?	☐	X	☐	
23	Does design impact Appendix 'R' requirements?	X	☐	☐	(12)
24	Does the equipment being installed/altered increase fire hazards in the area?	☐	X	☐	
25	If the equipment is safety-related, do fire hazards exist in the area which may impair its operability?	☐	X	☐	
26	Are fire barriers being breached by the design?	X	☐	☐	(13)
27	Are security barriers being breached by the design?	X	☐	☐	(13)
28	If safety-related, is new equipment located in proximity to high energy pipe whose failure could impair operability due to pipe whip, jet impingement, pressure or temperature conditions?	☐	X	☐	
29	If new equipment is a high energy system, is it located near safety-related equipment whose operability could be impaired due to failure of the new equipment?	☐	☐	X	

QUES. NO.	QUESTION	YES	NO	N/A	SEE OBSERVATION NUMBER
30	If the new equipment is safety-related, are there existing non-seismic items located such that their failure could impair the new equipment's safety function?	☐	X	☐	
31	If the new equipment is non-seismic, could its failure impair adjacent safety-related equipment functions?	☐	X	☐	
32	Have adequate measures been taken to maintain required separation between redundant equipment?	X	☐	☐	14
33	Are existing structures adequate for support of new equipment?	X	☐	☐	15
34	Has all adjacent equipment been identified to allow for answers to all of the questions?	X	☐	☐	

SECTION B
(Complete for Confirmation Walkdown only)

QUES. NO.	QUESTION	YES	NO	N/A	SEE OBSERVATION NUMBER
35	Are all temporary removals of grating, handrails, structural steel, conduit, tubing, piping, supports, equipment or instruments identified on installation drawings?	☐	☐	☐	
36	Are all permanent removals of grating, handrails, structural steel, conduit, tubing, piping, supports, equipment, or instruments identified on installation drawings?	☐	☐	☐	
37	Do installation drawings clearly define locations based on dimensions from existing physical objects?	☐	☐	☐	
38	Does design provide appropriate tolerances?	☐	☐	☐	
39	If modification deals with changing control board, were human factors considered?	☐	☐	☐	
40	Are there existing holes in the floors or walls to allow devices to be passed through?	☐	☐	☐	

WALKDOWN OBSERVATION

ITEM NO.	QUES. NO.	OBSERVATION (Attach sketch if required)	RESOLUTION (Attach sketch if required)
1	2	Clearance & work permits will be required for work in: NNI System Cabinets, Remote Shutdown Aux. Equipment Cabinets, Gamma Metrics Equipment Boxes, EFIC System, Events Recorder Cabinets and Main Control Board TGR.	
2	5	Special testing procedures will be required to verify the ATWS DSS & AMSAC equipment operation after installation.	
3	6	MAR's for RG 1.97 and Bailey "BY" transmitter replacement will be installed at the same time as this modification. Coordination of modification installation to enable access to equipment cabinets will be required.	
4	11	Equipment for this modification will be installed in existing equipment cabinets located in the control complex. Radiation exposure to personnel is therefore minimized.	
5	13	Conduit routing has been chosen which provides for minimum effort in installation of conduit & supports.	
6	14	The design does not change the maintenance efficiency of the existing systems.	
7	15	The design utilizes modular type components which can be replaced with minimum work effort.	
8	16	RH low to provide response by 5/5/86	

WALKDOWN OBSERVATION

ITEM NO.	QUES. NO.	OBSERVATION (Attach sketch if required)	RESOLUTION (Attach sketch if required)
9	17	RH Low to provide response by 5/5/86	
10	18	The design provides for easy check of the bistable trip setpoints.	
11	19	The design has built in capability for testing of bistable trip setpoints and trip actuations. Bypasses where required during testing are automatically implemented during testing.	
12	23	Isolation [illegible] remote shutdown system is accomp[illegible] through Foxboro safety grade [illegible]age/voltage isolation modules.	
13	26 & 27	Conduit must pass through existing fire and security barrier walls.	
14	32	Safety grade Foxboro V/V isolation modules are used to isolate signals between the remote shutdown aux. equipment cabinets and the NNI system cabinets. Safety grade digital isolators are used to isolate signals between the NNI system cabinets and the EFIC system cabinets.	
15	33	Existing cabinets have space to support the addition of the new equipment.	

WALKDOWN OBSERVATION

ITEM NO.	QUES. NO.	OBSERVATION (Attach sketch if required)	RESOLUTION (Attach sketch if required)
15	33	NNI system drawings identified locations 3-5-5, 3-5-6, and 3-5-7 as spare module locations. Equipment is already installed in these locations.	The DSS modules originally planned for these three locations will be relocated to positions 5-3-13, 5-3-14, and 5-3-15. To enable the above location change, AMSAC modules were relocated as follows: From → To 5-4-9 → 3-3-12 5-4-13 → 5-4-12 5-4-15 → 5-4-14 5-3-15 → 5-4-15
		NNI system drawings identified the following terminal board terminals as spare. However, wiring exists on these terminals. 8-7-6-1 thru 12 2-9-3 - 7 & 8 2-9-3 - 11, 12, 19 & 20 2-9-4 - 18 thru 23 2-9-5 - 13 & 14	Determine if wiring is required for system functions or if it is no longer required and can be removed.

Florida Power

DESIGN DATA SHEET

Crystal River Unit 3

REI / MAR Number	Date
84-06-07-01	10/28/86
Project	**System**
ATWS - DSS & AMSAC SYSTEMS	RC

SAFETY CRITERIA: ☐ Safety Listing Rev. ________ Dated ________, Page ________
☒ Safety Classification Review Form (attach copy)

SAFETY RELATED: ☒ Yes ☐ No

	YES	NO	APPLICABLE DESIGN INPUT REQUIREMENTS:
1.	☒	☐	Basic functions of each structure, system and component.
2.	☒	☐	Performance requirements such as capacity, rating, system output.
3.	☒	☐	Codes, standards, and regulatory requirements including the applicable issue and/or addenda.
4.	☒	☐	Design conditions such as pressure, temperature, fluid chemistry and voltage.
5.	☒	☐	Loads such as seismic, wind, thermal and dynamic.
6.	☒	☐	Environmental conditions anticipated during storage, construction and operation such as pressure, temperature, humidity, corrosiveness, site elevation, wind direction, nuclear radiation, electromagnetic radiation and duration of exposure. 10CFR50.49 applicability — For electrical equipment only, reference above Safety Listing page or attach copy of Environmental Qualification Requirements form.
7.	☒	☐	Interface requirements including definition of the functional and physical interfaces involving structures, systems and components.
8.	☒	☐	Material requirements including such items as compatibility, electrical insulation properties, protective coating and corrosion resistance.
9.	☐	☒	Mechanical requirements such as vibration, stress, shock and reaction forces.
10.	☐	☒	Structural requirements covering such items as equipment foundations and pipe supports.
11.	☐	☒	Hydraulic requirements such as pump net positive suction heads (NPSH), allowable pressure drops, and allowable fluid velocities.
12.	☐	☒	Chemistry requirements such as provisions for sampling and limitations on water chemistry.
13.	☒	☐	Electrical requirements such as source of power, voltage, raceway requirements, electrical insulation and motor requirements.
14.	☐	☒	Layout and arrangement requirements, to include potential adverse affects of non-seismically qualified masonry walls.
15.	☒	☐	Operational requirements under various conditions, such as plant startup, normal plant operation, plant shutdown, plant emergency operation, special or infrequent operation, and system abnormal or emergency operation.
16.	☒	☐	Instrumentation and control requirements including indicating instruments, controls and alarms required for operation, testing, and maintenance. Other requirements such as the type of instrument, installed spares, range of measurement, and location of indication should also be included.
17.	☒	☐	Access and administrative control requirements for plant security.
18.	☒	☐	Redundancy, diversity and separation requirements of structures, systems and components.
19.	☒	☐	Failure effects requirements of structures, systems and components, including a definition of those events and accidents which they must be designed to withstand.
20.	☒	☐	Test requirements including in-plant tests and the conditions under which they will be performed.
21.	☒	☐	Accessibility, maintenance, repair and inservice inspection requirements for the plant including the conditions under which these will be performed.

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
R. V. Liddle	10/28/86	T M Gada	10/29/86	L [illegible]	11/3/86

Florida Power

DESIGN DATA SHEET

Crystal River Unit 3

REI / MAR NUMBER	DATE
84-06-07-01	10/28/86
PROJECT	**SYSTEM**
ATWS - DSS & AMSAC SYSTEMS	RC

APPLICABLE DESIGN INPUT REQUIREMENTS: (Continued)

	YES	NO	
22.	☐	☒	Personnel requirements and limitations including the qualification and number of personnel available for plant operation, maintenance, testing and inspection and permissible personnel radiation exposures for specified areas and conditions.
23.	☐	☒	Transportability requirements such as size and shipping weight, limitations, I.C.C. regulations.
24.	☐	☒	Fire protection or resistance requirements:
			a. Changes or additions/deletion of fire detection/suppression systems or equipment.
			b. Changes or additions to the plant configuration that change the effectiveness of existing fire detection/suppression systems.
25.	☒	☐	Handling, storage and shipping requirements.
26.	☐	☒	Other requirements to prevent undue risk to the health and safety of the public.
27.	☒	☐	Materials, processes, parts and equiment suitable for application.
28.	☒	☐	Safety requirements for preventing personnel injury including such items as radiation hazards, restricting the use of dangerous materials, escape provisions from enclosures, and grounding of electrical systems.
29.	☐	☒	Addition or relocation of safe shutdown equipment, systems, components, or circuits that require compliance with the separation criteria stated in 10CFR50, Appendix R.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENGINEERING	DATE
R. V. Liddle	10/24/86	M. A. Gaba	10/30/86	L. M. Loisi	11/3/86

Florida Power Corporation

DESIGN INPUT RECORD
Crystal River Unit 3

Sheet 1 of 7

AE/MAR No. 84-06-07-01 | Date 10/28/86

Project: ATWS - DSS & AMSAC SYSTEMS

1. The principal function of the DSS is to prevent an ATWS by tripping the reactor, diverse from the existing RPS, to prevent a potential for damaging overpressurization of the RCS, if, for any reason, the rods have failed to drop in response to RPS trip.

   The principal function of the AMSAC is to mitigate the effects of an ATWS by actuating EFW and tripping the turbine to prevent serious RCS overpressurization, maintain fuel integrity and meet 10CFR release requirements in the unlikely event of no rod drop from either RPS or DSS.

2. Performance requirements for the DSS are that the system is energize to trip the power to the gate drivers for the CRD SCRs of the regulating and auxiliary groups when reactor coolant pressure exceeds 2450 psig. The total input instrument string error requirements is that it shall not exceed 1%. The electronic delay should not add more than one second to the overall time required to actuate the final actuated device.

   The undervoltage trip remains the safety related CRD trip licensing basis for reactor protection. The DSS function will be a backup to the undervoltage trip function.

   Performance requirements for the AMSAC are that the system is energize to trip the turbine and initiate EFW on a 100% loss of main feedwater. The electronic delay should not add more than one second to the overall time required to actuate the final actuated device.

3. The separation between the safety related systems and non-safety related will be designed to meet FPC requirements document CR-3-E247-A "Electrical Separation Criteria for Control Boards, Equipment Cabinets and Relay Racks", IEEE 279-1971, and 10CFR50, Appendix R.

   The equipment installed in safety related system will be environmentally qualified to IEEE 323-1974 requirements. The seismic qualification will be as to not degrade the safety grade equipment and will be designed to meet IEEE 344-1975 and IEEE 323-1974.

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
R. V. Liddle	10/28/86	[signature]	10/30/86	[signature]	11/3/86

REMAR No. 84-06-07-01 | Date 10/28/86

Project: ATWS - OSS & AMSAC SYSTEMS

3. Cont'd

This modification affects both safety and non-safety systems:

System	Classification
EFIC	Safety
Remote Shutdown System	Safety
Gamma Metrics	Safety
NNI	Non-Safety
CRDCS	Non-Safety
MCB TGR	Non-Safety
Sequence Event Recorder	Non-Safety

NRC requirement 10CFR50.62 states that all B&W plants must have a diverse scram system from sensor output to interruption of power to the control rods. The rule also states that each PWR must have equipment from sensor output to final actuation device to automatically initiate the emergency feedwater system and initiate a turbine trip under condition indicate a ATWS.

NRC Generic Letter 85-06 states the quality assurance guidance for the ATWS equipment that is not safety related.

4. Environment -

Florida Power Corporation's "Environmental and Seismic Qualification Program Manual" Zone 13 - Elev. 145' 0", attached, specifies the environmental conditions at the SER, NNI, and MCB TGR locations. The environmental conditions are:

Temperature - 70-80 ^{o}F

Radiation - 1×10^{4} Rad - 40 year Total Integrated Dose

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
P. V. Liddle	10/28/86	[illegible]	11/3/86	[illegible]	11/3/86

4. Cont'd

Zone 43 - Elev. 108' 0", attached, specifies the environmental condition at the RSAE and Zone 58 - Elev. 124' 0", attached, for CRD Cabinets, EFIC, and the GM. The Environmental conditions are the same for Zone 43 and 58 and are:

Temperature - 70-80 ^{o}F

Relative Humidity - 40-60%

Radiation - 1×10^{4} Rad - 40 year Total Integrated Dose

Voltage -

The DSS and AMSAC systems will be powered from existing power sources within the systems where the new equipment will be located.

5. Florida Power Corporations "Environmental and Seismic Qualification Program Manual" Table A and Figure 14, attached, specifies the seismic design basis for the RSAE equipment. Table A and Figure 15, attached, specify the seismic design basis for EFIC, and GM equipment. The equipment selected to provide isolation between safety and non-safety systems for implementation of the DSS and AMSAC functions will be qualified by the vendor to IEEE 344-1975.

Test reports and vendor certification will be obtained during equipment procurement to document equipment qualification.

Seismic qualification of RSAE, EFIC and GM cabinets reflecting the additional equipment required to implement DSS and AMSAC functions will be documented.

6. Operational environmental conditions for the equipment are those identified in No. 4 above. Prior to installation DSS and AMSAC electrical modules should be stored in a location meeting the requirements of ANSI N45.2.2 Level A. The remaining equipment maybe stored in Level B.

DIR/MAR No. 84-06-07-00 | Date 10/28/86

Project: ATWS - DSS & AMSAC SYSTEMS

7. The following is a list of the interfaces:

1. DSS

From	To	Isolation	Function
RSAE Cabinets A&B	Non-Nuclear Instrumentation (NNI) Cabinets	1E to $\overline{1E}$	Provide isolated RC WR Pressure signals
NNI Cabinets	Control Rod Drive Control System (CRDCS) DC Hold Supply Cabinet A	$\overline{1E}$ to $\overline{1E}$	Trip & Enable Contacts
CRDCS DC Hold Supply Cabinet A	Sequence of Events Recorder (SER)	$\overline{1E}$ to $\overline{1E}$	Test & Confirm Contacts
CRDCS DC Hold Supply Cabinet A	NNI Cabinets	$\overline{1E}$ to $\overline{1E}$	Test & Confirm Contacts

2. AMSAC

Gamma Metrics (GM) Channels A&B	NNI Cabinets	1E to $\overline{1E}$	Provide isolated Reactor Power Level signals
NNI Cabinets	EFIC A&D	$\overline{1E}$ to 1E	EFW Actuation Contacts
NNI Cabinets	MCB TGR	$\overline{1E}$ to $\overline{1E}$	Turbine Trip Relay Contacts
NNI Cabinets	SER	$\overline{1E}$ to $\overline{1E}$	Test and Confirm Contacts

REMAR No. 84-06-07-01 | Date 10/28/86

Project: ATWS - DSS & AMSAC SYSTEMS

8. All equipment added for this modification shall be new and not previously used. Equipment that has been in storage since manufacture and has not been previously used is considered new.

13. Power for the DSS and AMSAC equipment will be obtained from power sources within the existing systems where the equipment will be mounted. Wire insulation for DSS and AMSAC equipment installation shall be of the same type as the system in which the equipment is located. Cables used to interconnect the systems shall be safety grade from the CR-3 cable Bill of Material.

15. The AMSAC and DSS needs to be operational only during power operation and those conditions indicative of an ATWS which are LMFW and LOOP.

16. The DSS input parameter shall be RC Pressure, from the RSAE cabinets, ad changed will have a range of 0 to 3000 psig.

The AMSAC input parameters shall be main feedwater flow from the NNI system which has a range of 0 to 6×10^6 #/hr and reactor power from the Gamma Metrics system which has a range of 10^{-8} to 200% power.

Installed spares for the DSS and AMSAC systems are not required.

Analog indications of DSS and AMSAC system functions are not required. Analog indications of DSS and AMSAC input parameters are already installed where required.

Inputs are to be provided to the sequence events recorder to identify when the DSS or AMSAC systems have actuated or have been placed in test.

The DSS system is to provide trip of the reactor based upon high RC pressure. Modules and components to achieve this control action are to be mounted in the NNI and CRD systems. The RC pressure signal is to be derived from the RSAE cabinets.

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
P.V. Riddle	10/28/86	M.A. Gordon	10/29/86	L.M. Foster	11/3/86

REVISAR No. 84-06-07-01 | Date 10/28/86

Project: ATWS - DSS&AMSAC SYSTEMS

16. Cont'd

The AMSAC system is to provide turbine trip and initiation of EFW based upon total loss of main feedwater. The modules and components to achieve this control action are to be mounted in the NNI, MCB TGR, Gamma Metrics and EFIC systems. The main feedwater flow signals are available in the NNI cabinets. Reactor power level will be obtained at the Gamma Metrics equipment.

Safety grade to non-safety grade isolation is provided between safety and non-safety systems.

17. Existing administrative controls are adequate.

18. Redundancy - Two channel system for both DSS and AMSAC

Separation and isolation will be required from the following safety related systems: 1) RSAE A&B, 2) EFIC A&D, 3) GM A&B.

19. CRDMS must deenergize on Loss of Offsite Power (LOOP) so as to have an energize-to-trip DSS.

AMSAC must initiate on a LOOP.

20. DSS -

Upon completion of installation of the DSS, testing is to be performed to independently verify operation of the total circuitry used to trip the CRD gate drivers. After the initial installation tasting the DSS shall be tested every 6 months and every refueling. Testing at any time does not include the input sensors or dropping of the control rods.

AMSAC -

Upon completion of installation of the AMSAC, testing is to be performed to independently verify operation of the total circuitry used to trip the turbine and initiate EFW. After initial installation testing the AMSAC shall be tested every 6 months and every refueling. TEsting at any time does not include the input sensors or final actuation device.

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
D V. Liddle	10/28/86	M A Gaska	10/29/86	L M Foin	11/3/86

Florida Power

DESIGN INPUT RECORD
Crystal River Unit 3

REI/MAR No. 84-06-07-01

Date 10/28/86

Project: ATWS - DSS & AMSAC SYSTEMS

21. The safety related portions of the ATWS system, inputs from GM, RSAE and EFIC actuation, will continue to use the maintenance, repair, and inspection procedures that apply. The maintenance, repair, and inspection procedures used for non-safety systems will be used for the non-safety DSS and AMSAC circuitry.

25. Electronic modules handling, storage, and shipping requirements will be in accordance with ANSI N45.2.2 Level A.

    All other items on the bill of material are to be handled, stored, and shipped in accordance with standard vendor/FPC methods for that type of material.

27. The electrical components, wire and cable required for this modification shall be new and suitable for use in the system and environment in which it is located. Equipment that has been in storage since manufacture and has not been previously used is considered new.

28. Normal plant procedures for fabrication, installation, checkout, and operation of equipment are to be followed.

29. The equipment added in the RSAE Cabinets will be in compliance with the separation criteria stated in 10CFR50, Appendix R.

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
P. V. Riddle	10/28/86	[signature]	10/29/86	[signature]	11/3/86

FLORIDA POWER CORPORATION
Crystal River Unit 3

Zone Environmental Data

ZONE # 13

Revision 2

Date 10/85

DESCRIPTION: Elev. 145' - Control Complex, Between Columns 301 and 303

Parameters	Normal Environment		Environment For Loss Of Coolant Accident		Environment for High Energy Line Break (Inside A8 & 18)	
Temperature (°F)	Hours/Year	Temp.	Time	Temp.	Time	Temp.
	8760	70 to 80	N/A		N/A	
Pressure (PSIG)	Atmospheric		Time	Press.	Time	Press.
			N/A		N/A	-
Relative Humidity(%)	40 to 60		N/A		Time	%
					N/A	
Chemical Spray (pH)	N/A		N/A		N/A	
Radiation (Rads)	40 Year Dose		Time Post Accident	Dose		
	1.0 x 10⁴		1 Hr	N/A	N/A	
			1 Day	N/A		
			5 Days	N/A		
			30 Days	N/A		
			6 Months	N/A		
			40 Yr. Total + 6 Mo. = 1.0 x 10⁴ Total			
Submergence (Flood Level)	N/A		N/A		N/A	

LEGEND: N/A = Not Applicable, N/C = Not Calculated
NOTES:

FLORIDA POWER CORPORATION
Crystal River Unit 3

Zone Environmental Data

ZONE # 43

Revision 1

Date 4/83

DESCRIPTION: Elev. 95' and 108' - Control Complex

Parameters	Normal Environment		Environment For Loss Of Coolant Accident		Environment for High Energy Line Break (Inside A8 & I8)	
Temperature (°F)	Hours/Year	Temp.	Time	Temp.	Time	Temp.
	8760	70 to 80	N/A		N/A	
Pressure (PSIG)	Atmospheric		Time	Press.	Time	Press.
			N/A		N/A	
Relative Humidity(%)	40 to 60		N/A		Time	%
					N/A	
Chemical Spray (pH)	N/A		N/A		N/A	
Radiation (Rads)	40 Year Dose		Time Post Accident	Dose		
	1.0×10^4		1 Hr	Note 1	N/A	
			1 Day	Note 1		
			5 Days	Note 1		
			30 Days	Note 1		
			6 Months	Note 1		
			40 Yr. Total + 6 Mo. = 1.0×10^4 Total			
Submergence (Flood Level)	N/A		N/A		N/A	

LEGEND: N/A = Not Applicable, N/C = Not Calculated

NOTES: (1) Total 6 Month Integrated Accident Dose $\leq$ 100 Rads.

FLORIDA POWER CORPORATION
Crystal River Unit 3

Zone Environmental Data

ZONE # 58

Revision 1

Date 4/83

DESCRIPTION: Elev. 124' & 134' - Control Complex

Parameters	Normal Environment		Environment For Loss Of Coolant Accident		Environment for High Energy Line Break (Inside AB & IB)	
Temperature (°F)	Hours/Year	Temp.	Time	Temp.	Time	Temp.
	8760	70 to 80	N/A		N/A	
Pressure (PSIG)	Atmospheric		Time	Press.	Time	Press.
			N/A		N/A	
Relative Humidity(%)	40 to 60		N/A		Time	%
					N/A	
Chemical Spray (pH)	N/A		N/A		N/A	
Radiation (Rads)	40 Year Dose		Time Post Accident	Dose		
	1.0×10^4		1 Hr	N/A	N/A	
			1 Day	N/A		
			5 Days	N/A		
			30 Days	N/A		
			6 Months	N/A		
			40 Yr. Total + 6 Mo. = 1.0×10^4 Total			
Submergence (Flood Level)	N/A		N/A		N/A	

LEGEND: N/A = Not Applicable, N/C = Not Calculated
NOTES:

FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT 3

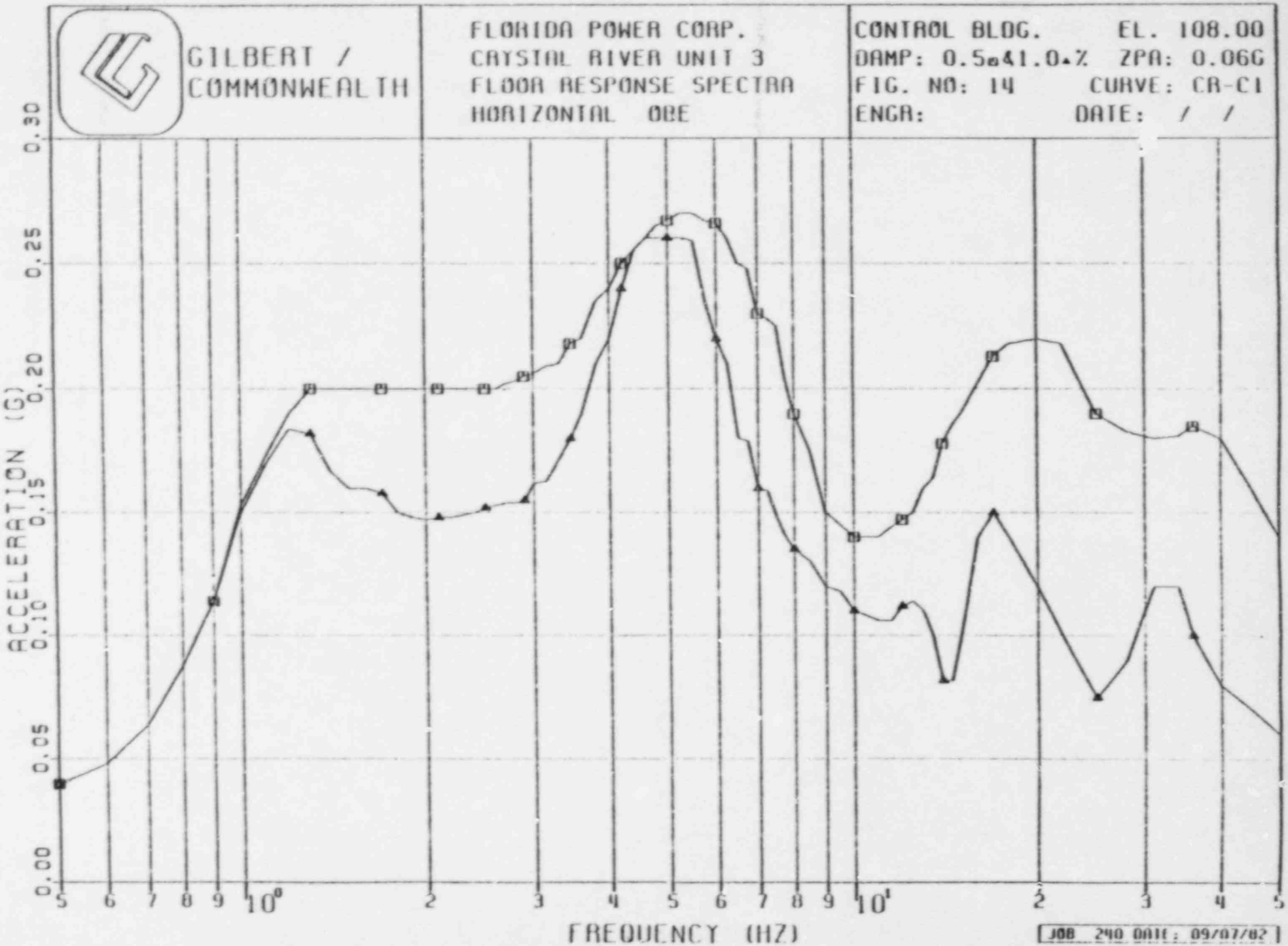
TABLE A

PANEL/CABINET MOUNTED EQUIPMENT
GROUND RESPONSE SPECTRUM FACTORS

Building	Elevation	Damping (%)	GRS Factor(1)
Reactor Building Shell	106.00	1/2	10.8
Reactor Building Shell	123.00	1/2	21.0
Reactor Building Shell	139.00	1/2	33.0
Reactor Building Shell	154.00	1/2	45.0
Reactor Building Shell	207.00	1/2	84.0
Reactor Building Interior	118.00	1/2	17.7
Reactor Building Interior	123.00	1/2	20.7
Reactor Building Interior	135.00	1/2	29.7
Reactor Building Interior	160.00	1/2	49.2
Reactor Building Interior	180.50	1/2	60.0
Auxiliary Building	119.00	1/2	16.2
Auxiliary Building	143.00	1/2	27.0
Auxiliary Building	162.00	1/2	31.2
Control Building	108.00	1/2	8.1
Control Building	124.00	1/2	12.0
Control Building	134.00	1/2	15.9
Control Building	145.00	1/2	20.4
Control Building	163.83	1/2	28.4
Control Building	183.83	1/2	35.9
Intermediate Building	149.00	1/2	21.8
Diesel Generator Building	143.00	1/2	21.0
Ground Response, Base Mat Reactor, Auxiliary, Intermediate, Control, and Diesel Generator Buildings	varies	1/2	5.7
Auxiliary Building	193.58	1/2	101.0
Auxiliary Building	209.08	1/2	131.0
Emergency Feedwater Tank Facility	118.5	1	20.1
Emergency Feedwater Tank Facility	143.0	1	72.0
Emergency Feedwater Tank Facility	168.0	1	115.0

Notes:

(1) The Required horizontal OBE Response Spectrum (RRS) to be used for qualification of panel/cabinet mounted devices is obtained by multiplying the Regulatory Guide 1.60 Ground Response Spectrum (GRS), Figure 24, by the above factor associated with the appropriate building and elevation where the equipment is located.


GILBERT / COMMONWEALTH
FLORIDA POWER CORP.
CRYSTAL RIVER UNIT 3
FLOOR RESPONSE SPECTRA
HORIZONTAL OBE
CONTROL BLDG. EL. 108.00
DAMP: 0.5&1.0% ZPA: 0.06G
FIG. NO: 14 CURVE: CR-C1
ENGR: DATE: / /
ACCELERATION (G)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
5 6 7 8 9 10^0 2 3 4 5 6 7 8 9 10^1 2 3 4 5
FREQUENCY (HZ)
JOB 240 DATE: 09/07/82

CONTROL BLDG. EL. 108.00

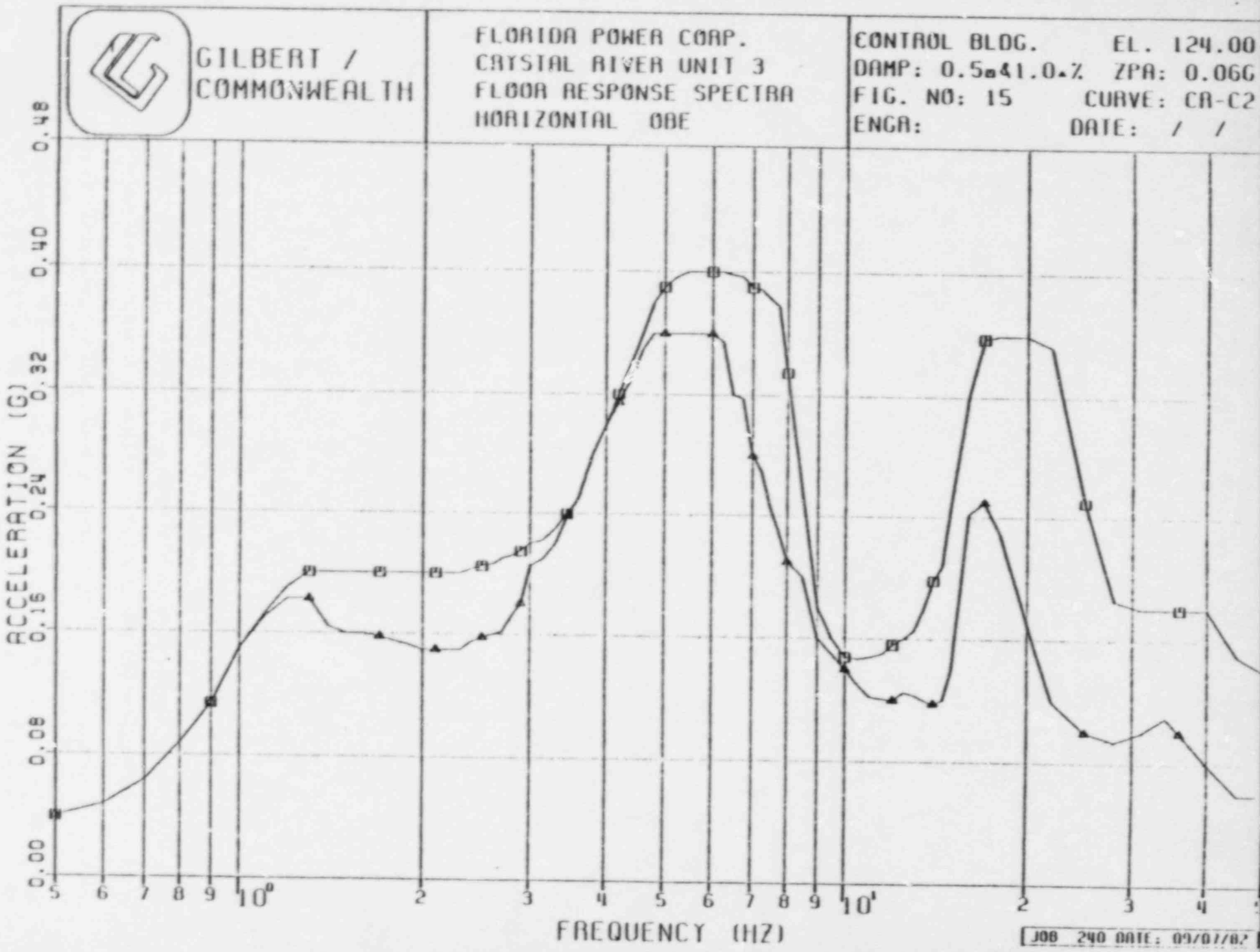
FIG. NO: 14 CURVE: CR-C1

DAMP: 0.5 % ZPA: 0.06G

FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION
0.500	0.040	0.600	0.048	0.700	0.064	0.800	0.088
0.900	0.114	1.000	0.153	1.100	0.173	1.200	0.190
1.300	0.200	1.400	0.200	1.500	0.200	1.600	0.200
1.700	0.200	1.800	0.200	1.900	0.200	2.000	0.200
2.100	0.200	2.200	0.200	2.300	0.200	2.400	0.200
2.500	0.200	2.600	0.200	2.700	0.202	2.800	0.203
2.900	0.205	3.000	0.206	3.150	0.209	3.300	0.210
3.450	0.218	3.600	0.220	3.800	0.235	4.000	0.240
4.200	0.250	4.400	0.255	4.600	0.260	4.800	0.265
5.000	0.267	5.250	0.270	5.500	0.270	5.750	0.267
6.000	0.266	6.250	0.260	6.500	0.250	6.750	0.248
7.000	0.230	7.250	0.228	7.500	0.225	7.750	0.204
8.000	0.190	8.500	0.175	9.000	0.150	9.500	0.145
10.000	0.140	10.500	0.140	11.000	0.140	11.500	0.144
12.000	0.147	12.500	0.150	13.000	0.160	13.500	0.164
14.000	0.178	14.500	0.185	15.000	0.190	16.000	0.202
17.000	0.213	18.000	0.218	20.000	0.220	22.000	0.218
25.000	0.190	28.000	0.183	31.000	0.180	34.000	0.181
36.000	0.185	40.000	0.180	45.000	0.160	50.000	0.140

DAMP: 1.0 % ZPA: 0.06G

FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION
0.500	0.040	0.600	0.048	0.700	0.064	0.800	0.088
0.900	0.114	1.000	0.150	1.100	0.170	1.200	0.184
1.300	0.182	1.400	0.167	1.500	0.168	1.600	0.160
1.700	0.158	1.800	0.150	1.900	0.148	2.000	0.147
2.100	0.148	2.200	0.148	2.300	0.149	2.400	0.150
2.500	0.152	2.600	0.153	2.700	0.154	2.800	0.154
2.900	0.155	3.000	0.162	3.150	0.163	3.300	0.172
3.450	0.180	3.600	0.190	3.800	0.210	4.000	0.220
4.200	0.240	4.400	0.255	4.600	0.260	4.800	0.260
5.000	0.260	5.250	0.260	5.500	0.259	5.750	0.235
6.000	0.220	6.250	0.210	6.500	0.180	6.750	0.179
7.000	0.160	7.250	0.159	7.500	0.148	7.750	0.140
8.000	0.135	8.500	0.130	9.000	0.120	9.500	0.118
10.000	0.110	10.500	0.108	11.000	0.106	11.500	0.106
12.000	0.112	12.500	0.114	13.000	0.110	13.500	0.100
14.000	0.082	14.500	0.082	15.000	0.100	16.000	0.140
17.000	0.150	18.000	0.140	20.000	0.120	22.000	0.100
25.000	0.075	28.000	0.090	31.000	0.120	34.000	0.120
36.000	0.100	40.000	0.080	45.000	0.070	50.000	0.060


GILBERT / COMMONWEALTH
FLORIDA POWER CORP.
CRYSTAL RIVER UNIT 3
FLOOR RESPONSE SPECTRA
HORIZONTAL OBE
CONTROL BLDG. EL. 124.00
DAMP: 0.5&1.0% ZPA: 0.06G
FIG. NO: 15 CURVE: CR-C2
ENGR: DATE: / /
ACCELERATION (G)
0.00
0.08
0.16
0.24
0.32
0.40
0.48
5 6 7 8 9 10⁰ 2 3 4 5 6 7 8 9 10¹ 2 3 4
FREQUENCY (HZ)
JOB 240 DATE: 09/07/82

CONTROL BLDG. EL. 124.00

FIG. NO: 15 CURVE: CR-C2

DAMP: 0.5 % ZPA: 0.06G

FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION
0.500	0.040	0.600	0.048	0.700	0.064	0.800	0.088
0.900	0.114	1.000	0.150	1.100	0.172	1.200	0.190
1.300	0.200	1.400	0.200	1.500	0.200	1.600	0.200
1.700	0.200	1.800	0.200	1.900	0.200	2.000	0.200
2.100	0.200	2.200	0.200	2.300	0.200	2.400	0.203
2.500	0.205	2.600	0.206	2.700	0.210	2.800	0.212
2.900	0.215	3.000	0.220	3.150	0.222	3.300	0.230
3.450	0.240	3.600	0.250	3.800	0.280	4.000	0.300
4.200	0.320	4.400	0.340	4.600	0.360	4.800	0.380
5.000	0.390	5.250	0.397	5.500	0.400	5.750	0.400
6.000	0.400	6.250	0.400	6.500	0.398	6.750	0.397
7.000	0.390	7.250	0.389	7.500	0.383	7.750	0.378
8.000	0.335	8.500	0.255	9.000	0.180	9.500	0.160
10.000	0.148	10.500	0.147	11.000	0.148	11.500	0.150
12.000	0.156	12.500	0.160	13.000	0.165	13.500	0.179
14.000	0.198	14.500	0.208	15.000	0.250	16.000	0.320
17.000	0.358	18.000	0.360	20.000	0.360	22.000	0.353
25.000	0.250	28.000	0.185	31.000	0.180	34.000	0.180
36.000	0.180	40.000	0.180	45.000	0.150	50.000	0.140

DAMP: 1.0 % ZPA: 0.06G

FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION	FREQUENCY	ACCELERATION
0.500	0.040	0.600	0.048	0.700	0.064	0.800	0.088
0.900	0.114	1.000	0.150	1.100	0.170	1.200	0.182
1.300	0.182	1.400	0.164	1.500	0.160	1.600	0.160
1.700	0.158	1.800	0.155	1.900	0.153	2.000	0.150
2.100	0.150	2.200	0.150	2.300	0.150	2.400	0.155
2.500	0.158	2.600	0.160	2.700	0.162	2.800	0.172
2.900	0.180	3.000	0.205	3.150	0.210	3.300	0.220
3.450	0.238	3.600	0.250	3.800	0.280	4.000	0.300
4.200	0.315	4.400	0.330	4.600	0.350	4.800	0.360
5.000	0.360	5.250	0.360	5.500	0.360	5.750	0.360
6.000	0.360	6.250	0.355	6.500	0.320	6.750	0.318
7.000	0.280	7.250	0.270	7.500	0.245	7.750	0.229
8.000	0.210	8.500	0.200	9.000	0.160	9.500	0.150
10.000	0.140	10.500	0.130	11.000	0.122	11.500	0.121
12.000	0.120	12.500	0.125	13.000	0.123	13.500	0.120
14.000	0.118	14.500	0.120	15.000	0.140	16.000	0.242
17.000	0.250	18.000	0.230	20.000	0.170	22.000	0.120
25.000	0.100	28.000	0.094	31.000	0.100	34.000	0.110
36.000	0.100	40.000	0.080	45.000	0.060	50.000	0.060

SAFETY CLASSIFICATION REVIEW
Crystal River Unit 3

Item	Component
ATWS - DSS & AMSAC SYSTEMS	

Generic ☐ Yes ☒ No Application

System	Req. No.	P. O. No	MMIS No.
RC			

Safety Related ☒ Yes ☐ No

☐ Yes — Does the item/service assure the integrity of the reactor coolant system boundary (i.e., "Pressure-retaining" as defined in ASME Boiler and Pressure Vessel Code)?
- ☒ Not part of reactor coolant system.
- ☒ Not pressure-retaining per Code.

☒ No

☒ Yes — Does the item/service assure the capability to shut down the reactor and to maintain it in a safe shut-down condition?
(If no, justification is on attachment).

☐ No

☐ Yes — Does the item/service assure the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10CFR100.11?
(If no, justification is on attachment)

☐ No

Item/Service is Safety-Related

Item/Service is Non Safety-Related

NOTE:
If item is considered to be electrical equipment, the Environmental Qualification Requirements Review form must be completed to determine 10CFR50.49 applicability.

Design Engineer	Date	Verification Engineer	Date	Supervisor Nuclear Engineering	Date
P. V. Liddle	10/28/86	M. B. Gordon	10/29/86	L. M. Lamb	11/3/86

Florida Power

ANALYSIS/CALCULATION
Crystal River Unit 3

Sheet 1 of 1

REV/MAR No.	Date
84-06-07-01	10/28/86

Project: ATWS- DSS & AMSAC SYSTEMS

Does the item/service assure the capability to shut down the reactor and to maintain it in a safe shutdown condition?

No, the DSS does shut down the reactor but it is only a backup function to the safety related Reactor Protection System trip. The DSS or AMSAC does not maintain the reactor in a safe shutdown condition. The non-safety status of the ATWS system, DSS and AMSAC, is in accordance with the NRC Generic Letter 85-06.

Does the item/service assume the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10CFR100.11?

Yes, of the ATWS system, the DSS does prevent consequences of an ATWS and the AMSAC system does mitigate consequences of a ATWS to within the limits of 10CFR100.11. The non-safety portion of ATWS systems is in accordance with the NRC Generic Letter 85-06. The safety related and non-safety system except for the CRD breakers are assumed to function properly during an ATWS event.

The DSS and AMSAC systems are not required to be safety related. However, these systems interface with EFIC, RSAE Cabinets and the Gamma Metrics equipment which are classified as safety related. The DSS &nd AMSAC interfaces with these systems are therefore safety related. All other parts of this modification are non-safety related.

Design Engineer	Date	Verification Engineer	Date	Supervisor, Nuclear Engineering	Date
P. V. Riddle	10/28/86	M. A. Gulbin	10/29/86	L. M. Fair	11/3/86

Rev 7/81

312 244

Florida Power

FIRE PROTECTION REVIEW
Crystal River Unit 3

REI / MAR NUMBER	DATE
84-06-07-01	10/28/86
PROJECT ATWS - DSS & AMSAC SYSTEMS	**SYSTEM** RC

YES	NO		
		1.	Does the design/design change involve the modificaiton, addition, removal, or relocation of any of the following? If yes, explain in space provided.
X	☐	a.	Combustibles (oil, hydraulic fluid, grease, wood-based materials, cloth, charcoal, PVC, cable insulation, carpet, etc.) Specific quanties & types of cable/wire insulation will be enumerated during detailed design.
☐	X	b.	Available Fire Protection (detectors, fire extinguishers, hose stations, sprinklers, halon system, CO_2 system, etc.)
☐	X	c.	Equipment, components, or cables that would interfere with the operation of existing fire detection, emergency lighting, or other fire protection features.
☐	X	d.	Penetrations, penetration seals, or conduit seals.
X	☐	e.	Space Separators (walls, ceilings, floors, doors, curbs, dampers, etc.) Specific wall penetrations by conduit will be enumerated during detailed design.
X	☐	f.	Fireproofing, exposure fire protection, cable tray covers/wrapping, conduit wrapping, etc. Specific conduit/cable tray wrapping will be enumerated during detailed design.
☐	X	2.	Will this design/design change require a revision to the Fire Hazards Analysis? Reference EG-4, Sect. V.D.
☐	X	3.	Does this design/design change deviate from any applicable NFPA Fire Code requirement in safety-related or safe shutdown areas/zone? If yes, explain below and obtain Fire Protection Engineer review and concurrence.

DESIGN ENGINEER	DATE	FIRE PROTECTION ENGINEER (if concurrence required by Item 3)	DATE
P. V. Liddle	10/28/86		

4/86 ORIGINAL - MAR YELLOW - Sr. Nuclear Fire Protection Specialist RET: Life of Plant (MP) RESP: Nuclear Engineering 912 253

Zm 2 11/3/86

TEST OUTLINE

Diverse Scram System (DSS)

NNI-X (NNI-Y Similar)

1. Place test switch in enable.
2. "Enable" light lit.
3. "Trip 1 Enable" light lit. (NNI-X & Y)
4. DSS in Test - SER on.
5. Place test switch in test.
6. Adjust voltage source above setpoint to trip bistable.
7. "CRD Actuate" light lit.
8. "Trip 1 Confirm" light lit.
9. DSS Trip 1 - SER on.
10. Place test switch in enable.
11. "Trip 1 Confirm" light off.
12. DSS Trip 1 - SER off.
13. "Enable" light lit.
14. "Trip 1 Enable" light lit. (NNI-X & Y)
15. Place test switch in off.
16. DSS in Test - SER off.
17. All lights off.

CRD Test and Seal-in Circuit

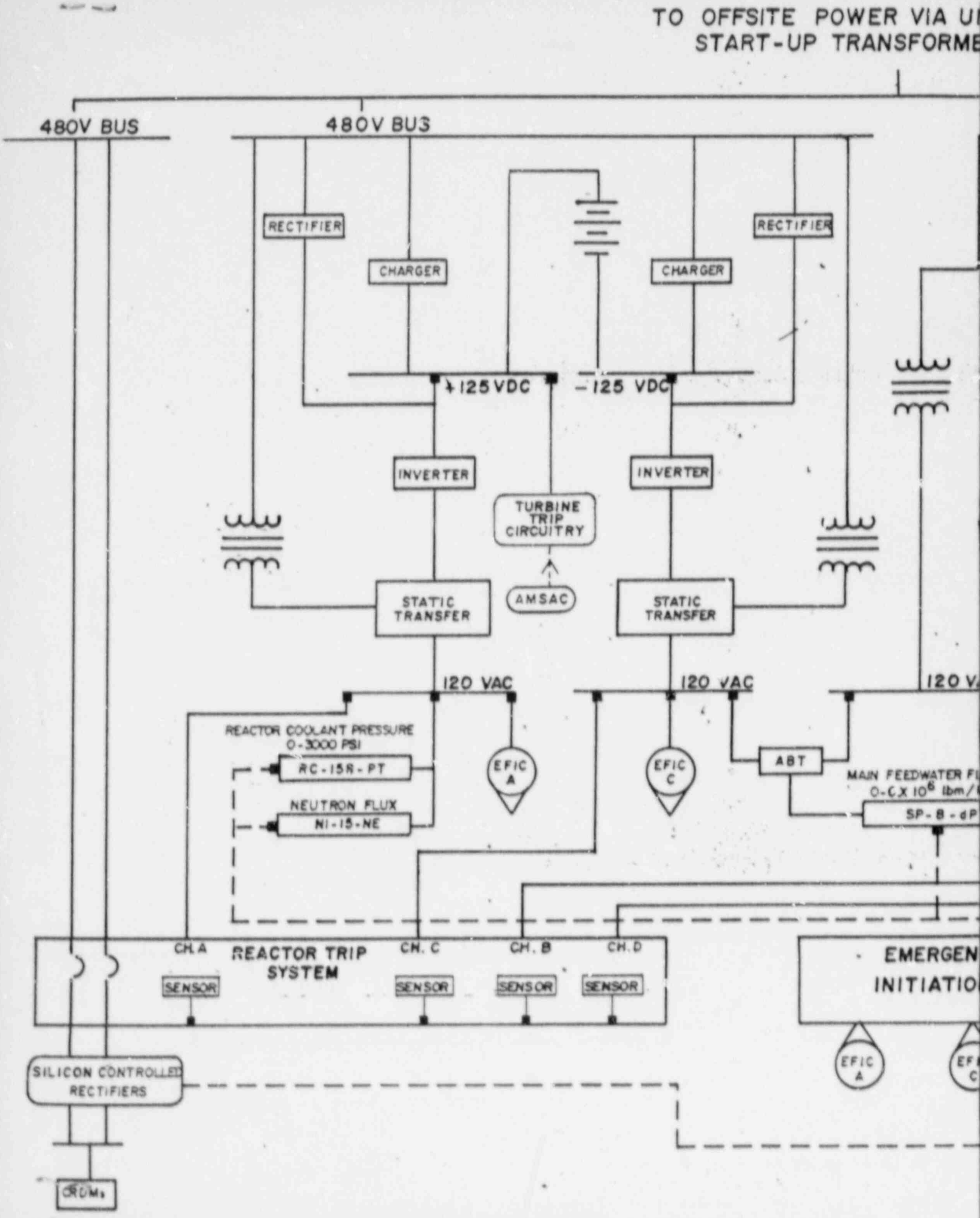
1. "Trip 1 Armed" light lit.
2. "Trip 2 Armed" light lit.
3. Place S1-1 in enable.
4. "Test 1 Enable/Bypass" light lit.
5. "Trip 2 Armed" light off.
6. DSS in Test - SER on.
7. Place S1-1 in test.
8. "Trip 1 Confirm" light lit.
9. DSS Trip 1 - SER on.
10. Place S1-2 in enable.
11. "Trip 1 Confirm" light off.
12. DSS Trip 1 - SER off.
13. "Test 2 Enable/Bypass" light lit.
14. "Trip 1 Armed" light off.
15. Place S1-2 in test.
16. "Trip Lockup" light lit.
17. Place S1-2 in off.
18. "Trip 1 Armed" light lit.
19. "Test 2 Enable/Bypass" light off.
20. "Trip 1 Confirm" light lit.
21. DSS Trip 1 - SER on.
22. Reset S2
23. "Trip Lockup" light off.
24. Place S1-2 in test.
25. "Test 2 Enable/Bypass" light lit.
26. "Trip 1 Armed" light off.

27. "Trip 1 Confirm" light off.
28. DSS Trip 1 - SER off.
29. "Trip Lockup" light on.
30. Place S1-1 in off.
31. "Trip 2 Armed" light lit.
32. "Test 1 Enable/Bypass" light off.
33. "Trip 2 Confirm" light lit.
34. DSS Trip 2 - SER on.
35. Reset S1
36. "Trip Lockup" light off.
37. "Trip 2 Confirm" light lit.
38. Place S1-2 in off.
39. "Trip 2 Confirm" light off.
40. "Trip 1 Armed" light lit.
41. DSS Trip 2 - SER off.
42. DSS in Test - SER off.

ATWS Mitigation System Actuation Circuit (AMSAC)

NNI-X (NNI-Y Similar)

1. Place test switch in enable.
2. "Enable" light lit.
3. AMSAC in Test - SER on.
4. Place test switch in test.
5. Adjust voltage source of flux bistable above setpoint.
6. Adjust voltage source of loop A main feedwater flow signal above setpoint.
7. "Trip" light lit.
8. "Turb Trip Conf" light lit.
9. AMSAC Trip - SER on.
10. EFIC A EFW Tripped - on EFIC panel.
11. Place NNI-Y test switch in enable.
12. "Turb Trip Conf" light off.
13. Place NNI-Y test switch in off.
14. "Turb Trip Conf" light lit.
15. Adjust voltage source of flux bistable below setpoint.
16. "Trip" and "Turb Trip Conf" lights off.
17. Adjust voltage source below setpoint of loop A main feedwater flow signal.
18. Reset EFIC A.
19. Repeat steps 6-13 for other voltage source for loop B main feedwater flow signal.
20. Place test switch in enable.
21. "Turb Trip Conf" light off.
22. Place test switch in off.
23. AMSAC in Test - SER off.
24. All lights off.


TO OFFSITE POWER VIA U
START-UP TRANSFORME
480V BUS
480V BUS
RECTIFIER
CHARGER
CHARGER
RECTIFIER
+125VDC
-125 VDC
INVERTER
INVERTER
TURBINE TRIP CIRCUITRY
AMSAC
STATIC TRANSFER
STATIC TRANSFER
120 VAC
120 VAC
120 V
REACTOR COOLANT PRESSURE 0-3000 PSI
RC-15R-PT
NEUTRON FLUX
NI-15-NE
EFIC A
EFIC C
ABT
MAIN FEEDWATER FL
0-C X 10^6 lbm/
SP-B-dP
CH.A
REACTOR TRIP SYSTEM
CH. C
CH. B
CH.D
SENSOR
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EMERGEN
INITIATIO
EFIC A
SILICON CONTROLLED RECTIFIERS
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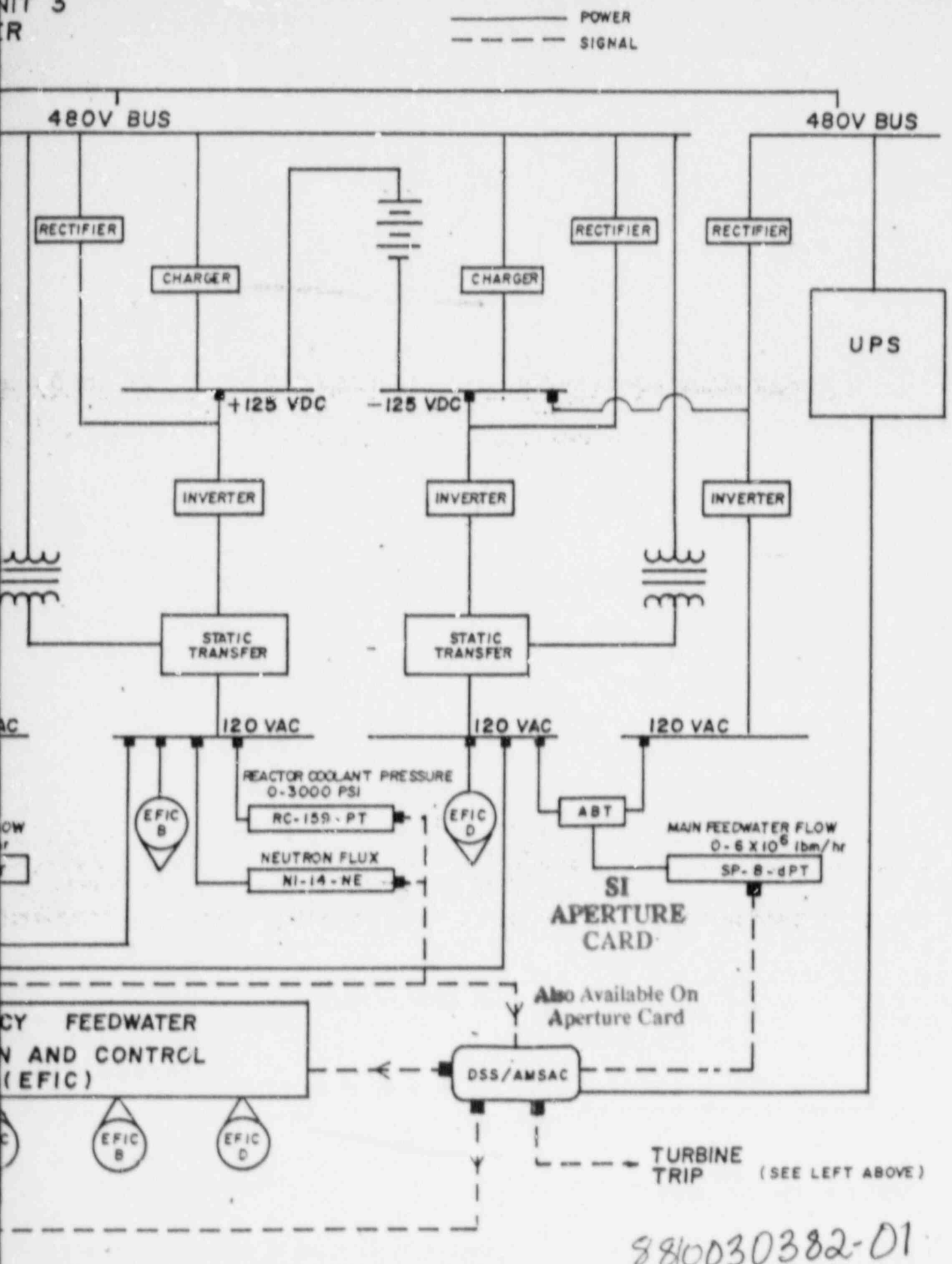

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