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Norman W. Curtis
Vice President-Engineering & Construction-Nuclear
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SEP 21 1983

Dr. Thomas E. Murley
Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
631 Park Ave.
King of Prussia, PA 19406

SUSQUEHANNA STEAM ELECTRIC STATION
SUMMARY OF MEETING TO DISCUSS SSES
POWER, VOLTAGE AND RELAY STUDY
ER 100508 FILE 841-4
PLA-1832

Docket No. 50-388

Reference: PLA-1801 dated 8/24/83

Dear Dr. Murley:

The attachments to this letter provide a summary of a meeting held in PP&L's Allentown offices on Wednesday September 7, 1983 to discuss the SSES Power, Voltage, and Relay Study as well as related topics. This meeting included representatives from NRC Inspection and Enforcement Region I and Nuclear Reactor Regulation.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

Attachments:
Attachment A - Meeting Summary
Attachment B - Cable Length Deficiency Slides
Attachment C - Voltage Study Slides
Attachment D - Relay Study Slides
Attachment E - List of Attendees

cc: R. Perch - NRC
C. Anderson - NRC
A. Finkel - NRC
S. Rhow - NRC
G. Rhoads - NRC
L. Plisko - NRC
A. Schwencer - NRC

IE01

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Attachment A

MEETING SUMMARY

I. Cable Length Deficiency (Deficiency Report DR141)

PP&L opened the meeting with a discussion of a potentially reportable deficiency involving cable lengths. A copy of the slides used during the discussion is included as Attachment B. Significant points brought up during this discussion were:

A. Liberalized Design Criteria - PP&L liberalized the original design criteria provided that certain conditions are met:

1. All cables with liberalized criteria will be included on a special drawing.

2. Documentation is provided to justify the liberalization.

B. Methods of Guaranteeing & Controlling Design Adequacy in the Future - PP&L reviews all applicable design change impacts on the voltage characteristics of the plant.

Commitment: PP&L to provide NRC with final report on this potentially reportable deficiency at the conclusion of the verification process. This report will address the justification for liberalizing the PP&L design criteria, a summary of the changes associated with the cable lengths and a method for controlling future changes to these circuits. The anticipated submittal date of this report to the NRC is 10/31/83.

II. T-10 Transformer Project

Discussions regarding the T-10 Transformer Project centered in 3 areas:

A. Installation - The installation of the rewound transformer was in progress during the meeting and is now complete.

B. Testing - Transformer in shop testing by Westinghouse (repair contractor) and on site testing by PP&L were discussed.

C. Events after Failure - The condition of the transformer after the failure and the plants reaction to the transient after the failure were discussed.

Commitment:, PP&L to provide NRC with final report on the T-10 failure when all analyses and reviews are complete. This report will be submitted in October 1983.

III. Power, Voltage & Relay Study

PP&L presented the combined Unit 1 & Unit 2 Voltage and Relay Studies. Key points of the presentation were:

A. A Unit 1 LOCA is the worst case because Unit 1 loading is higher due to the fact that many common loads are off Unit 1 buses.

B. In all cases, the calculated voltages exceed the voltage criteria by the 2% design margin.

C. Faults in 1 division or load group will not cause the loss of any other division or load group.

D. Faults in the non-Class IE loads will not cause the loss of any Class IE loads.

Slides used during this presentation are included under Attachment C (voltage) and Attachment D (Relay).

Commitment: PP&L to provide a formal, final version of the SSES Power, Voltage, and Relay study to the NRC. The anticipated date of submittal is 9/23/83.

IV. ESS Transformer Project

PP&L provided the NRC representatives in attendance with an update on the current status of the ESS Transformer Project. At the time of the meeting, the installations of the transformers was in progress. Installation completion is scheduled for the intertie outage (currently scheduled for November-December 1983). The transformers will be demonstrated operable by completion of Startup Test Procedure P200.

Commitment: PP&L to submit FSAR change with new AC Distribution System for NRC review. This will be submitted by 10/15/83.

Attachment B

CABLE LENGTH DEFICIENCY SLIDES

DR 0141

DESCRIPTION OF DEFICIENCY: FROM JULY 1, 1981 TO NOV. 4, 1982, BECHTEL FAILED TO ACCOMPLISH THE DESIGN AND VERIFICATION OF SAFETY RELATED POWER AND CONTROL CABLES IN ACCORDANCE WITH EDPI 2.16.1.

CONSEQUENCE OF DEFICIENCY: SUITABILITY OF INSTALLED CABLES IS INDETERMINATE.

DR 0141

CORRECTIVE ACTION:

1. BECHTEL TO DEVELOP LIST OF ALL CABLES INVOLVED IN DR 0141
   - o 1058 UNIT I CABLES
   - o 2478 UNIT II CABLES

2. BECHTEL TO VERIFY ALL CABLES ON LIST MEET DESIGN REQUIREMENTS
   - o DETERMINE MAXIMUM LENGTH
   - o DETERMINE INSTALLED LENGTH

3. PP&L TO AUDIT BECHTEL ACTION ITEMS 1 AND 2
   - o TECHNICAL ADEQUACY
   - o PROCEDURAL REQUIREMENTS

DR 0141

BECHTEL FINDINGS:

- O INITIAL DESIGN CRITERIA TOO CONSERVATIVE
- O LIBERALIZE DESIGN CRITERIA
- O NO CABLES MUST BE REPLACED OR REWORKED

PP&L FINDINGS:

- O INITIAL DESIGN CRITERIA CAN BE LIBERALIZED IF ALL CASES NOT MEETING INITIAL CRITERIA ARE DOCUMENTED.
- O TECHNICAL ADEQUACY OF SOME CABLES MUST BE BETTER DOCUMENTED.

  232 UNIT I CABLES

  502 UNIT II CABLES

DR 0141

CURRENT ACTIVITIES:

- O BECHTEL TO COMPLETE REVIEW BY OCTOBER 15
- O BECHTEL TO SUBMIT ALL REVISED CALC'S TO NPE
- O NPE TO REVIEW FOR COMPLIANCE WITH DESIGN CRITERIA

STATUS :

BECHTEL REVIEW COMPLETE

UNIT I: 44 OF 232 AS OF 9/2/83

UNIT II: 403 OF 502 AS OF 9/2/83

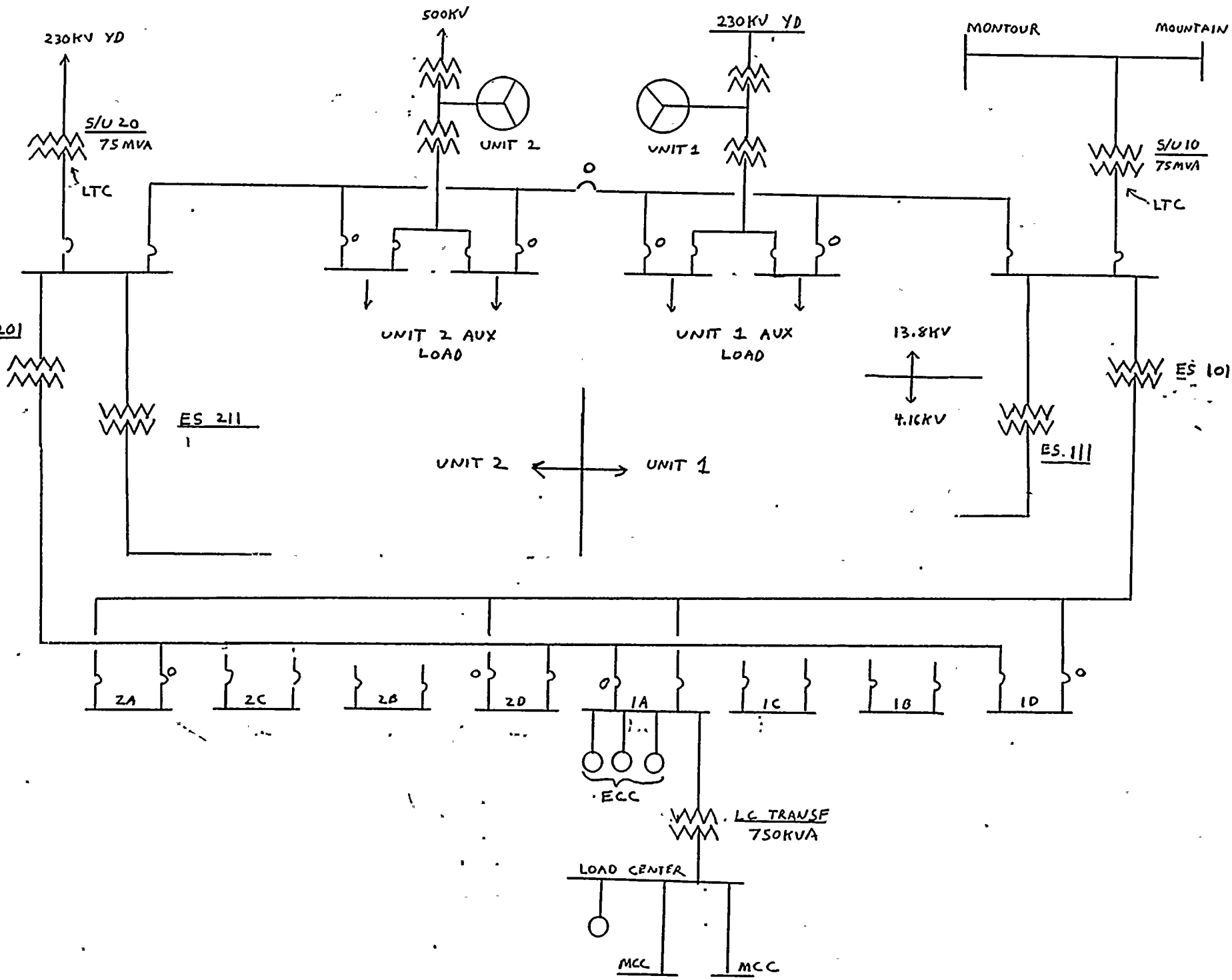
PP&L REVIEW COMPLETE

UNIT I: NONE AS OF 9/2/83

UNIT II: 159 OF 502 AS OF 9/2/83

Attachment C

VOLTAGE STUDY SLIDES



APPENDIX B

LARGE BREAK LOCA WITHOUT LOOP

TIMERS: RHR PUMPS C&D 7.5" AFTER INITIATION, CORE SPRAY PUMPS 15" AFTER INITIATION, ANTIMOTORING RELAY TRIP IN 30"

PRE LOCA: BOTH UNITS AT FULL POWER. THE LOCA UNITS OPERATING AT AN ABNORMALLY LOW LEVEL (LEVEL 3) STARTUP TRANSFORMER LTC CONTROL SET AT 14,170V.

SEQUENCE OF EVENTS: PER GE - ANALYSIS RE BLP-18123.

t = 0	Reactor Recirc Line Break Occurs	- high drywell pressure signal
		- start: diesel generators, DG air compressors, OV201A, OV109A, OV101A & OE143A
		- trip D.G. space heaters
t = 2"	Reactor at Level 2 (-38")	- ATWS initiated, 10" delay until reactor recirc. pump trip
		- MSIV closure initiated (MSIV 3-5" to close)
		- trip: RHR service water (if running)
t = 5.3"	Reactor at Level 1 (-129")	- initiate RHR and core spray start
		- trip reactor and turbine building chillers
		- start RHR pumps A & B
t = 6"	MSIV 100% Closed	- steam supply to turbine generator shut off (8-10" delay until pressure = 0)
t = 12"	Reactor Recirc. Pump Trips by ATWS	
t = 12.8"	RHR Pumps C & D Start	
t = 15" (±2")	Steam Pressure at Turbine Generator = 0	- Anti motoring relay begins to time out (30" delay)
t = 20.3"	4 Core Spray Pumps Start	
t = 22.8"	Reactor Pressure at 400 PSI (Set point 430 PSI ±30)	- permissive for core spray and RHR injection valves
		- RHR injection valves 1F015 A&B start from ISO MG Set (24" valve)

APPENDIX B (Continued)

LOCA WITHOUT LOOP

t = 23.8"	Core Spray Pumps Running	- remaining injection valves start when voltage recovers (core spray injection 1F004A&B, 1F005A&B 12" to open; RHR INJ 1F0017A&B if closed require 24" to open)
t = 26.8"	Reactor Pressure at 280 PSI	- permissive for closure of reactor recirc. discharge valve (1F031A,B 30" for closure)
t = 32.0"	Core Spray Inj Valve 68% Open	- core spray at design flow
t = 35.8"	Core Spray Inj Valve Fully Open	
t = 40"	Start ESW Pumps A & B	
t = 45" (±2")	Unit Trip by Anti Motoring Relay	- dip in grid voltage
		- load shedding initiated
		- remaining auxiliary load transfer to startup bus
t = 47.8"	Both RHR Injection Valves Fully Open	
t = 53"	Start ESW Pump C	
t = 56.8"	Reactor Recirc Discharge Valve Fully Closed	- LPIC at full flow
t = 57"	Start ESW Pump D	
t = 70"	One Condensate Pump Restarts Automatically	- automatic start sequence complete

LARGE BREAK

CASE:

NORMAL LOAD - FIX LTC TAPS TO MAINTAIN SCHEDULE ON STARTUP BUS.

START ECC

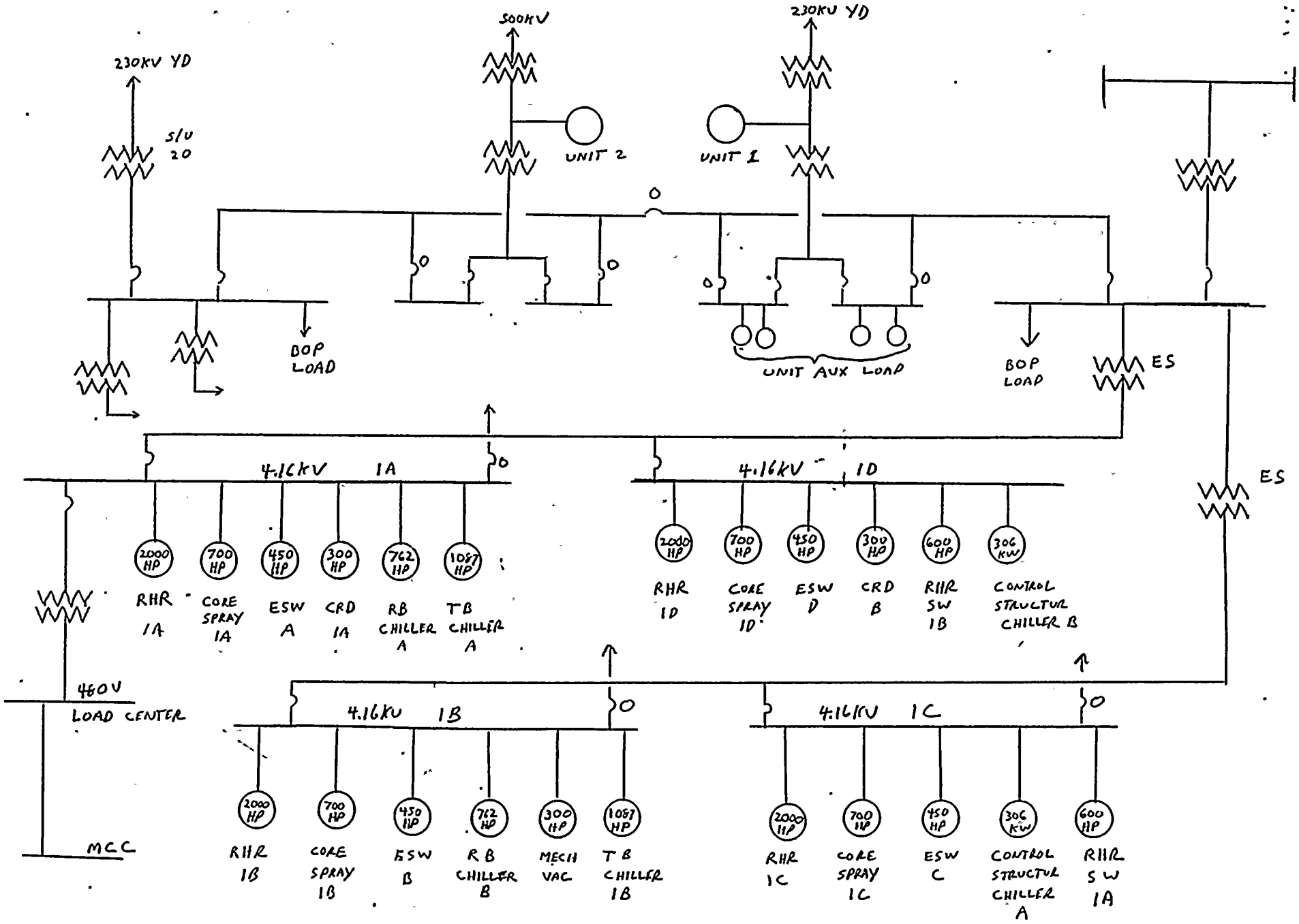
START RHR PUMPS A & B
RUN ALL ABOVE
START RHR PUMPS C & D
RUN ALL ABOVE
START 4 CORE SPARY PUMPS
RUN ALL ABOVE
START ESW A & B
RUN ALL ABOVE

UNIT TRIP (GRID VOLTAGE DIP)

AUX. LOAD SHED & TRANSFER TO S/U BUS
START ESW C
RUN ALL ABOVE
START ESW D
RUN ALL ABOVE
AUTO RESTART OF CONDENSATE D
RUN ALL ABOVE

POST LOCA

NO MANUAL LOAD SHED ALL ESF LOADS RUN.
RESTART RHR


500KV
230KV YD
230KV YD
S/U 20
UNIT 2
UNIT 1
BOP LOAD
BOP LOAD
UNIT AUX LOAD
ES
ES
4.16KV 1A
4.16KV 1D
2000 HP
700 HP
450 HP
300 HP
762 HP
1087 HP
RHR 1A
CORE SPRAY 1A
ESW A
CRD 1A
RB CHILLER A
TB CHILLER A
2000 HP
700 HP
450 HP
300 HP
600 HP
306 KW
RHR 1D
CORE SPRAY 1D
ESW D
CRD B
RHR SW 1B
CONTROL STRUCTUR CHILLER B
480V LOAD CENTER
MCC
4.16KV 1B
4.16KV 1C
2000 HP
700 HP
450 HP
762 HP
300 HP
1087 HP
RHR 1B
CORE SPRAY 1B
ESW B
RB CHILLER B
MECH VAC
TB CHILLER 1B
2000 HP
700 HP
450 HP
306 KW
600 HP
RHR 1C
CORE SPRAY 1C
ESW C
CONTROL STRUCTUR CHILLER A
RHR SW 1A

APPENDIX D

INTERMEDIATE BREAK CASE WITHOUT LOOP

Timers: RHR starts - C & D Pumps 7.5" after level 1
Core starts - All core spray 15" after level 1
ESW starts - A & B Pumps 40", Pump C 53", Pump D 57" after high drywell
Antimotoring relay - 30" time delay
Condensate Restart - 25"-30" after level 1 or high drywell pressure and unit trip

Pre LOCA: Startup transformer LTC control set at 14170V

Medium Break LOCA Occurs

High Drywell Pressure	- start diesel generator
	- initiate 480V loads
	- initiate ESW start ESW A & B start in 40" ESW C in 53", ESW D in 57"
Level 2	- ATWS was initiated, 10" delay to trip of reactor recirc pumps
	- MSIV closure initiated, unit trip by antimotoring relay in 30" to 40" seconds after level 2
Case 1 Unit Trips Here	- grid voltage dips
	- sheds 13.8 KV load
	- transfer unit Aux buses to S/U transformer
Level 1	- start RHR pumps A & B
	- initiate RHR pump C & D start in 7.5" and core spray start in 15"
	- initiate restart of condensate D 25"-30" if unit has tripped
RHR A & B Start	
RHR C & D Start with ESW A & B	
Core Spray Start	
Case 2 Unit Trips Here	- dip in grid voltage
	- 13.8 KV load shed
	- unit aux buses transfer to S/U bus
	- initiates restart of condensate pump D in 25"-30"

INTERMEDIATE BREAK

CASE 1

UNIT TRIP (DIP IN GRID VOLTAGE)

SHED UNIT AUX LOAD, TRANSFER AUX BUS TO S/U BUS, START RHR A & B

RUN ABOVE

START RHR C & D WITH ESW A & B

RUN ABOVE

START ALL CORE SPRAY

RUN ABOVE

CASE 2

START RHR A & B ESW A & B

RUN ABOVE

START RHR C & D AND ESW A & B

RUN ABOVE

START ALL CORE SPRAY AND ESW A & B

RUN ABOVE

VOLTAGE CRITERION

1) THE STEADY STATE VOLTAGE SHALL BE WITHIN ± 10% OF RATED VOLTAGE.

2) THE VOLTAGE AT THE MOTOR TERMINALS SHALL NOT BE LESS THAN 80% OF RATED WHEN STARTING.

3) THE MINIMUM TRANSIENT VOLTAGE PERMITTED AT A 480 VOLT MOTOR CONTROL CENTER IS 70% OF RATED.

MINIMUM VOLTAGES

MINIMUM STEADY STATE VOLTAGES AT

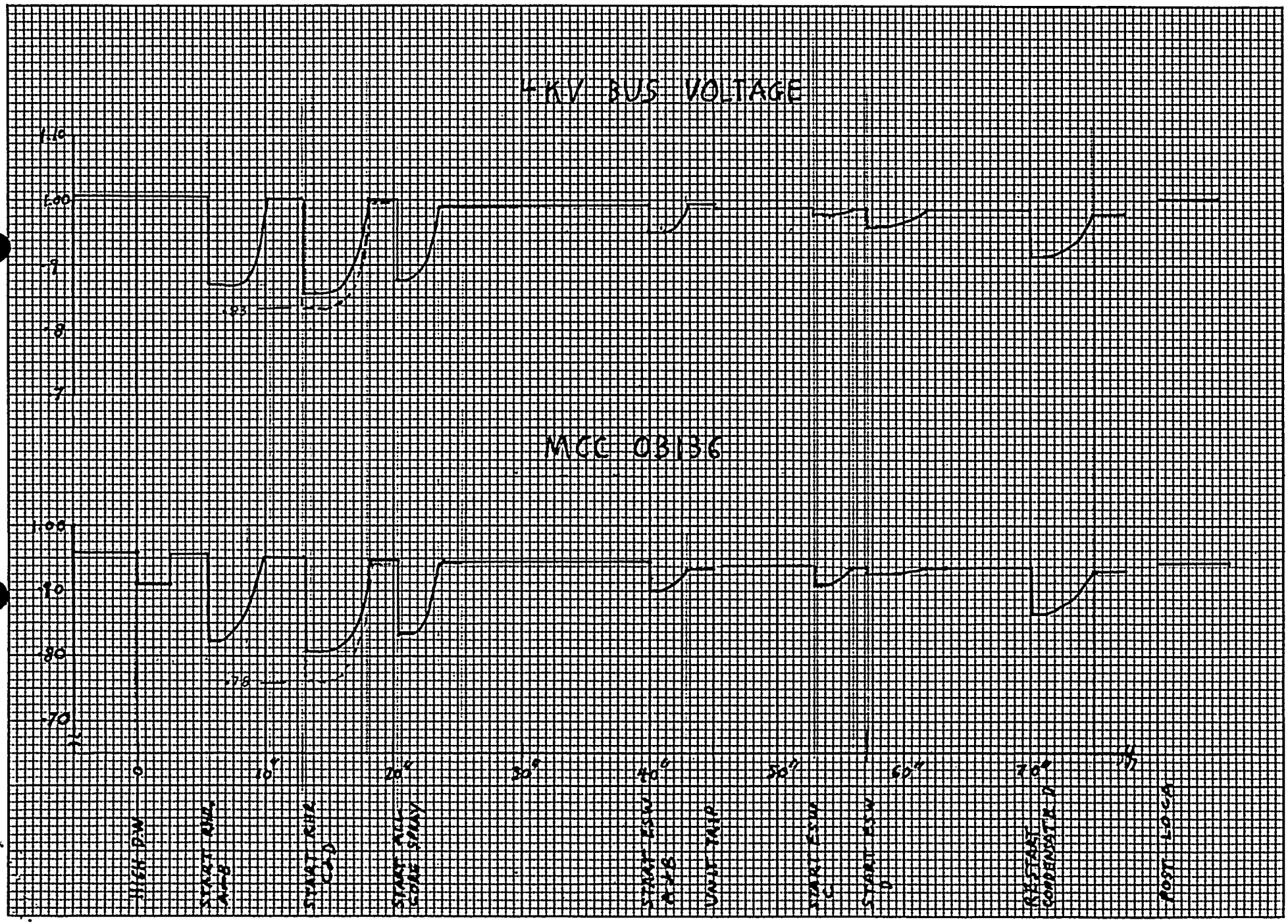
4KV BUS = 1.002 PU

480V MCC = .946

120 VOLT PANEL = .97 PU

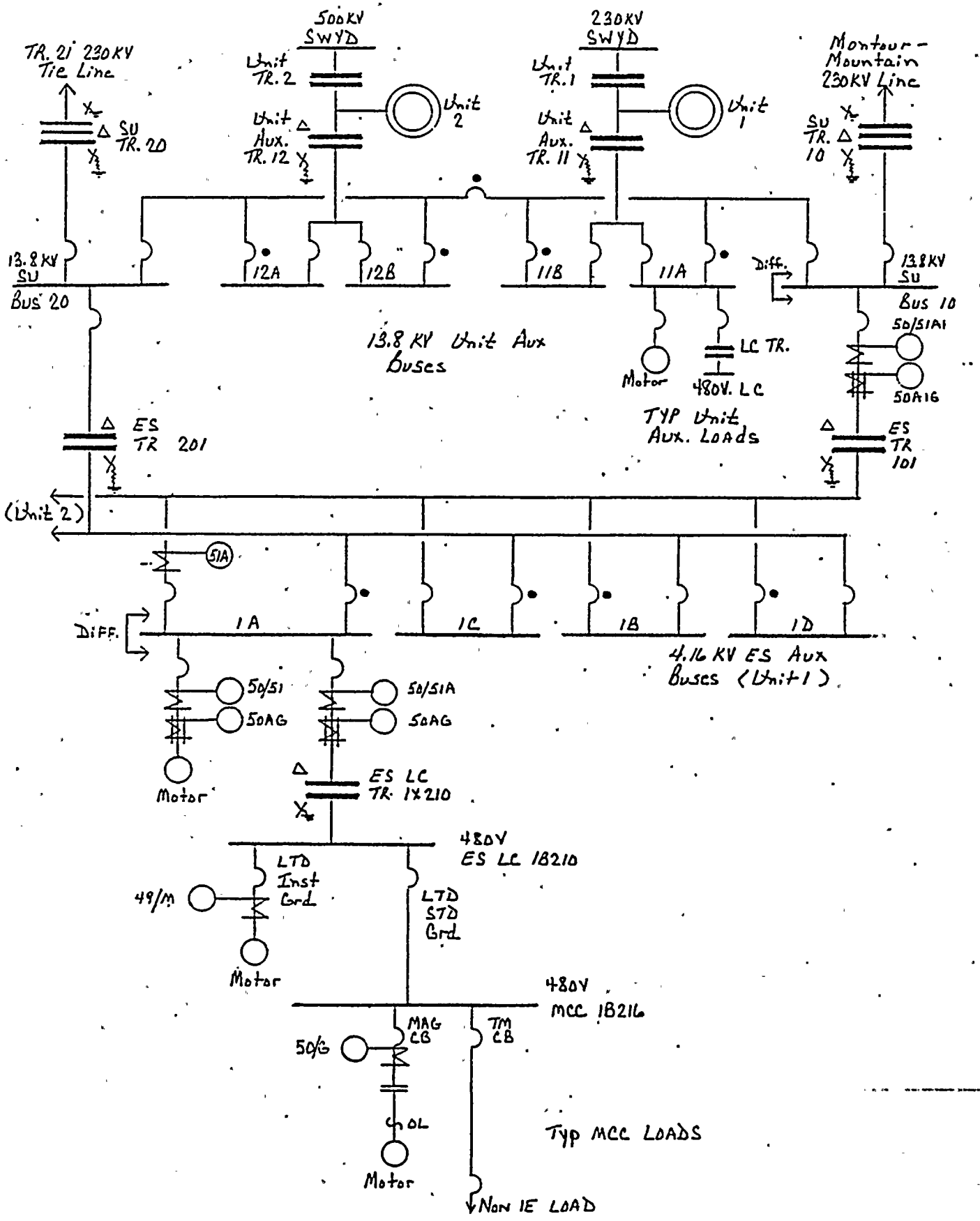
MINIMUM STARTING VOLTAGE FOR 4KV MOTOR = .84 PU

MINIMUM MCC VOLTAGE DURING STARTING TRANSIENT = .78 PU



Attachment D

RELAY STUDY SLIDES



CLASS 1E RELAY CRITERION

PICKUP SETTINGS

PROTECTIVE DEVICES SHALL:

1) BE SET TO CARRY THE CONTINUOUS RATING OF THE LOWEST RATED SERIES DEVICE IN THE CIRCUIT.

2) PERMIT CONTINUOUS OPERATION OF MOTOR LOADS AT 80% RATED VOLTAGE.

3) BE SET ABOVE THE MAXIMUM LOAD CONDITION PLUS THE LOCKED ROTOR CURRENT OF THE LARGEST NON 1E MOTOR ON THE BUS.

4) NOT BE SET ABOVE 134% OF THE CABLE RATING.

PROTECTION

1) REDUNDANT PROTECTION IS REQUIRED FOR THE PENETRATION ASSEMBLIES.

2) CABLE PROTECTION SHALL BE PROVIDED FOR MAXIMUM FAULT CONDITIONS.

CLASS 1E RELAY CRITERION

COORDINATION

1) FAULTS IN ONE DIVISION OR LOAD GROUP WILL NOT CAUSE THE LOSS OF ANY OTHER DIVISION OR LOAD GROUP.

2) THE CLASS 1E INTERRUPTING DEVICE APPLIED BETWEEN THE NON-1E LOAD AND THE CLASS 1E SOURCE MUST SELECT WITH THE UPSTREAM PROTECTIVE DEVICE.

MOTOR PROTECTION

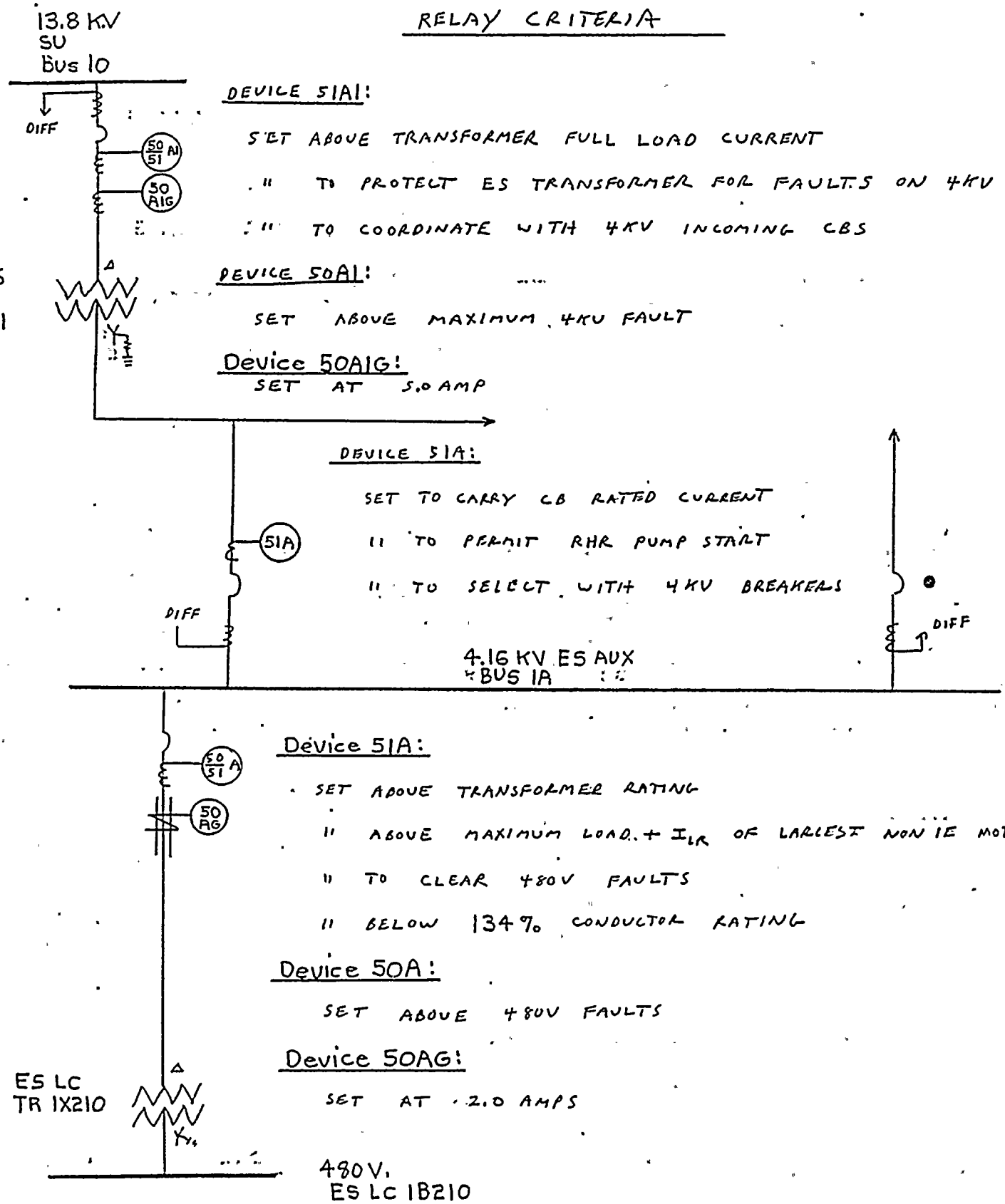
1) OVERCURRENT SETTINGS SHALL PERMIT CONTINUOUS MOTOR OPERATION AT 80% VOLTAGE.

2) ALARM RELAYS SHALL BE SET AS NEAR 115% RATED FULL LOAD CURRENT AS POSSIBLE.

3) TIME DELAY SETTINGS SHALL PERMIT STARTING AT 100% AND 80% RATED MOTOR VOLTAGE. A MARGIN OF 3" OR 40% OF THE STARTING TIME, WHICHEVER IS HIGHER, SHALL EXIST BETWEEN THE MOTOR STARTING CHARACTERISTIC AND THE O.C. RELAY CURVE.

4) INSTANTANEOUS TRIPS SHALL BE SET ABOVE 165% OF THE LOCKED ROTOR CURRENT.

RELAY CRITERIA



DEVICE 51A1:

SET ABOVE TRANSFORMER FULL LOAD CURRENT

" TO PROTECT ES TRANSFORMER FOR FAULTS ON 4KV

" TO COORDINATE WITH 4KV INCOMING CBS

DEVICE 50A1:

SET ABOVE MAXIMUM 4KV FAULT

Device 50A1G:

SET AT 5.0 AMP

DEVICE 51A:

SET TO CARRY CB RATED CURRENT

" TO PERMIT RHR PUMP START

" TO SELECT WITH 4KV BREAKERS

Device 51A:

SET ABOVE TRANSFORMER RATING

" ABOVE MAXIMUM LOAD + I_{LR} OF LARGEST NON 1E MOTOR

" TO CLEAR 480V FAULTS

" BELOW 134% CONDUCTOR RATING

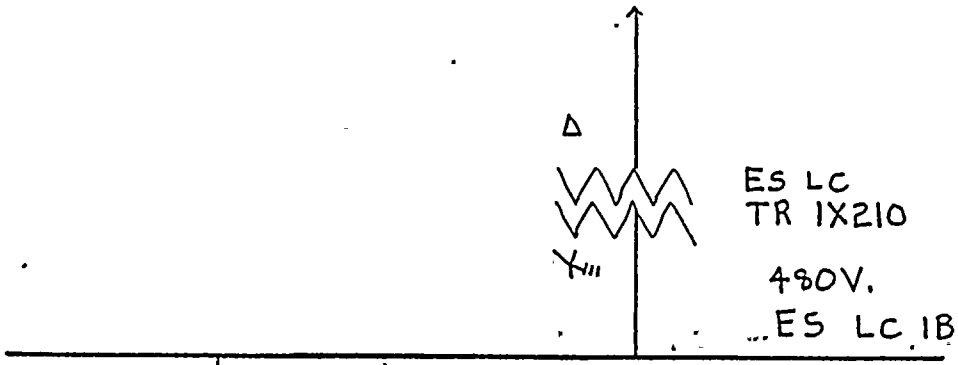
Device 50A:

SET ABOVE 480V FAULTS

Device 50AG:

SET AT 2.0 AMPS

RELAY CRITERIA



SOLID STATE

LTD, STO, Grd. } - SET TO SELECT FOR FAULTS ON NON-1E LOADS
- PERMIT CONTINUOUS OPERATION AT 80% VOLTAGE

- SET ABOVE CIRCUIT RATING

- SET BELOW 134% CABLE RATING

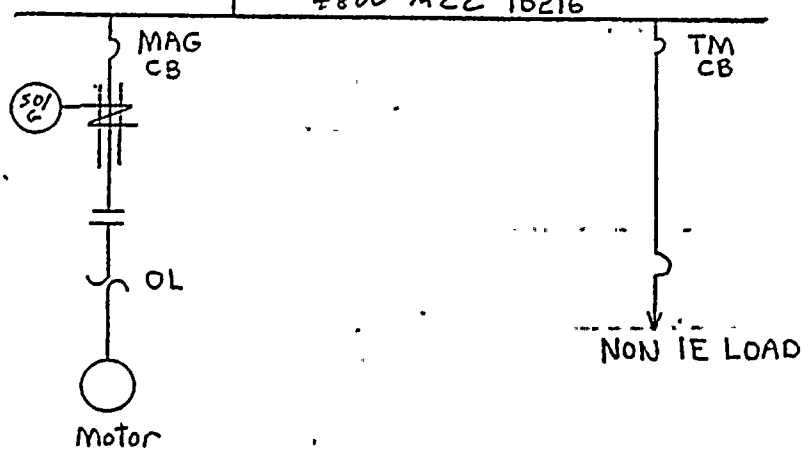
- PERMIT REACCELERATION FOLLOWING A BUS TRANSFER

- SET ABOVE THE MAXIMUM LOAD PLUS THE LOCKED ROTOR CURRENT OF THE LARGEST NON 1E MOTOR

- SET TO PROTECT CABLE

- GROUND TRIP IS SET ABOVE LARGEST CB w/o Dev. 50/G

- GROUND TRIP WILL SELECT WITH DEV. 50/G.



Attachment E

LIST OF ATTENDEES

Name	Title / Dept.
John Tripoli	Engineer - Licensing
VERN OHEIM	G.E. - NRC
GARY RHOADS	USNRC Senior Resident Inspector
ALAN FINKEL	USNRC Lead Reactor Eng.
LOREN PLISCO	USNRC REACTOR ENGINEER
Cliff Anderson	USNRC, Chief PSS
Dan Weatherly	Relay Section, S.O. Dept.
Ed Guro	Relay Section, System Operating
Tom Domin	Relay Section, System Operating
Sam Tuba	NPE Elec
Sang Rhow	NRC/NRR/DSI/PSB
Tony Sleva	NPE - Elect
ROBERT PERCH	USNRC, PROJ. MGR
Neil Coddington	Sr. Project Engineer - Licensing
DON REIMERT	NPE - ELECTRICAL