Vepco

VIRGINIA ELECTRIC AND POWER COMPANY, RICHMOND, VIRGINIA 23261

August 7, 1979

Mr. James P. O'Reilly, Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Serial No. 403A
PSE&C/WLT:mac:wang

Docket No. 50-339

Dear Mr. O'Reilly:

On April 27, 1979, a report was made under the provisions of 10CFR50.55(e) concerning potential overloads of electrical systems which supply offsite power. This report was followed by our interim report dated May 23, 1979. The work described is very near completion at this time and we are hereby submitting our final report of this situation.

Our letter dated May 23, 1979 stated that the loading through the components which carry power from offsite, under the conditions defined, cause no degradation of equipment life for 1 hour of operation. Also, we mentioned the fact that automatic shedding of certain non-essential normal loads would be required under the postulated conditions to achieve acceptable voltage levels and to minimize available fault currents.

The worst case reserve system loading that was considered in the design of the modification was one (1) unit in the start-up mode on reserve power and the other unit at 100% power on station service power then tripping and the resultant transfer to the reserve power system. This represents the most conservative condition to consider in evaluating the reserve system loading requirements.

Using the above condition as the plant operating requirement we then used the following Emergency Bus requirements as a design basis. The Emergency Buses should not be inadvertently transferred from the preferred source (RSST) to the standby source (Emergency Diesels) on a transfer of the running unit to the reserve transformers. Therefore, the voltage on the emergency buses must remain above 90% indefinitely or it must recover to greater than 90% in 60 seconds or in the case of a safety injection, within 10 seconds.

Certain pre-conditions will be required to assure that the worst-case loading used in the voltage studies is not exceeded. These conditions also assure that one feedwater pump and one condensate pump will be running in each unit after automatic load shedding has occurred. These conditions are as follows:

1. Any time a unit is in a start-up mode when the other unit is on the line, a selector switch on the transformer protection panels for the start-up unit must be placed in the "Start-Up" position.

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2. The unit that is on the line will be using two of three steam generator feed pumps; the start-up unit will use only one feedwater pump (this complies with the system design). It will be required that the start-up unit use the feedwater pump with a letter designation (which indicates the bus that it is fed from) which is different from the two operating on the other unit. For example, if the unit on the line has its "A" and "C" feedwater pumps operating, the start-up unit must use its "B" feedwater pump.

3. The start-up unit must use the condensate pump which is fed from the same bus as its running feedwater pump. For instance, if "B" feedwater pump is used for start-up, the "B" condensate pump must also be used.

4. The unit that is on the line may be running all three condensate pumps or must be running the two condensate pumps that are fed from the same buses that are feeding the two running feedwater pumps.

With these pre-conditions in effect, automatic load shedding will occur upon the trip of the unit on the line and subsequent fast transfer of the loads from the normal station service to the reserve station service.

This load shedding will trip off all high and low pressure heater drain pumps, two of three condensate pumps, and one of two feedwater pumps in the unit that was transferred to the reserve source.

Other data and assumptions that have been used in this study are as follows:

A. Minimum voltage on 500kv bus is 508kv based on studies which have previously been transmitted.

B. The reserve transformer load tap changer will correct voltages to the maximum extent possible. For motor starting conditions (accident cases) the LTC position before the incident was determined based on reasonably expected pre-conditions, then was assumed to remain in this position while the emergency motors are started.

C. Safety injection actuation results in tripping of all feedwater pumps on that unit.

D. No operator action to reduce load is assumed to occur for 1 hour after a unit trip.

E. Degraded voltage relay protection on the 4160 volt emergency buses has been considered and will not separate the emergency buses from the preferred source for the conditions analyzed.

The enclosed data shows the results of our studies. This data clearly illustrates that for the worst case conditions examined, as defined earlier, the system will have acceptable voltage levels, both for emergency motor starting and continuous operation of all equipment. Following is a brief description of all enclosures:

Enclosure A: Three graphic results of studies conducted to examine the worst case loading configurations which can occur for the two unit station under the non-accident conditions defined earlier. The loads indicated are those which will remain after load shedding. The three different conditions represent the variations in loading that will occur dependent upon which feedwater pump the start-up unit uses. These results indicate that the voltages available on the 4160 volt and 480 volt emergency buses are adequate to operate all the loads continuously.

Enclosure B: Two graphic results of studies conducted to examine the two worst case loading configurations which could occur for containment depressurization actuation accident conditions. These cases are for accident conditions on one unit with subsequent fast transfer of loads, while the other unit is in its start-up mode, and for accident conditions for a unit while in start-up with the other unit tripped at 100% power with subsequent fast transfer of loads. These results show that adequate voltages are available to start and continuously run all required emergency loads. It should be noted that the large emergency motors reach full speed within four seconds, by which time the voltage will have recovered to above 90% of the bus voltage rating.

Enclosure C: The enclosed one-line diagrams show the revised electrical power distribution system.

Enclosure D: The enclosed logic diagrams show the annunciation and control sequence for the load shedding scheme, the reserve station service load monitoring, and the revised relaying necessitated by the revisions to the distribution system.

Enclosure E: The enclosed letter from General Electric Company to our Mr. John M. Davis dated June 8, 1979 documents that our reserve station service transformer can carry 156% of maximum nameplate rating for one hour without significant loss of life.

We are continuing with other studies to further upgrade the offsite power supplies to unit auxiliary loads such that load shedding and administrative controls of equipment usage will not be required. These studies include consideration of the addition of Units 3 and 4 at this site.

We consider this transmittal to fully define the capabilities of our reserve station service system as it applies to the two unit station. We feel that this system meets all requirements of offsite power capability imposed by General Design Criterion 17, as well as criteria of good general design practice. If you need any further information, please contact this office.

Very truly yours,

Sam C. Brown, Jr.
Senior Vice President - Power Station
Engineering and Construction

cc: Mr. Victor Stello, Director
Office of Inspection & Enforcement

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation

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POOR ORIGINAL

Enclosure A

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UNIT	TFMR	FWP	CNP	BCP	SDP HI	SDP LO	RCP	CWP	EM. BUS
STARTUP UNIT 2	A	(△)	(△)		○	○	⊙		⊙ ↓
	B	⊙	⊙	⊙	○		⊙	⊙ ⊙	↓
	C	(△)	(△)		○	○	⊙	⊙ ⊙	⊙
TRIPPED UNIT 1	A	(△)	(△)		◎	◎	⊙		↑
	B	(△)	(△)	⊙	◎		⊙	⊙ ⊙	⊙ ↑
	C	⊙	⊙		◎	◎	⊙	⊙ ⊙	⊙

CONDITIONS AFTER TRIP - RESERVE STATION SERVICE SYSTEM LOADS

TFMR	% LOAD
A	59.30
B	138.74
C	135.77

Legend

- (blank) NOT RUNNING
- ⊙ RUNNING
- ◎ PREVIOUSLY RUNNING, NOW TRIPPED
- ○ PREVIOUSLY STANDBY, NOW TRIPPED
- (△) △ AUTO START DISABLED AUTOMATICALLY THROUGH OPERATOR-PRESET KEY SWITCHES
- ↑ FED FROM OTHER TRANSFORMER WHEN UNIT 2 IS STARTUP

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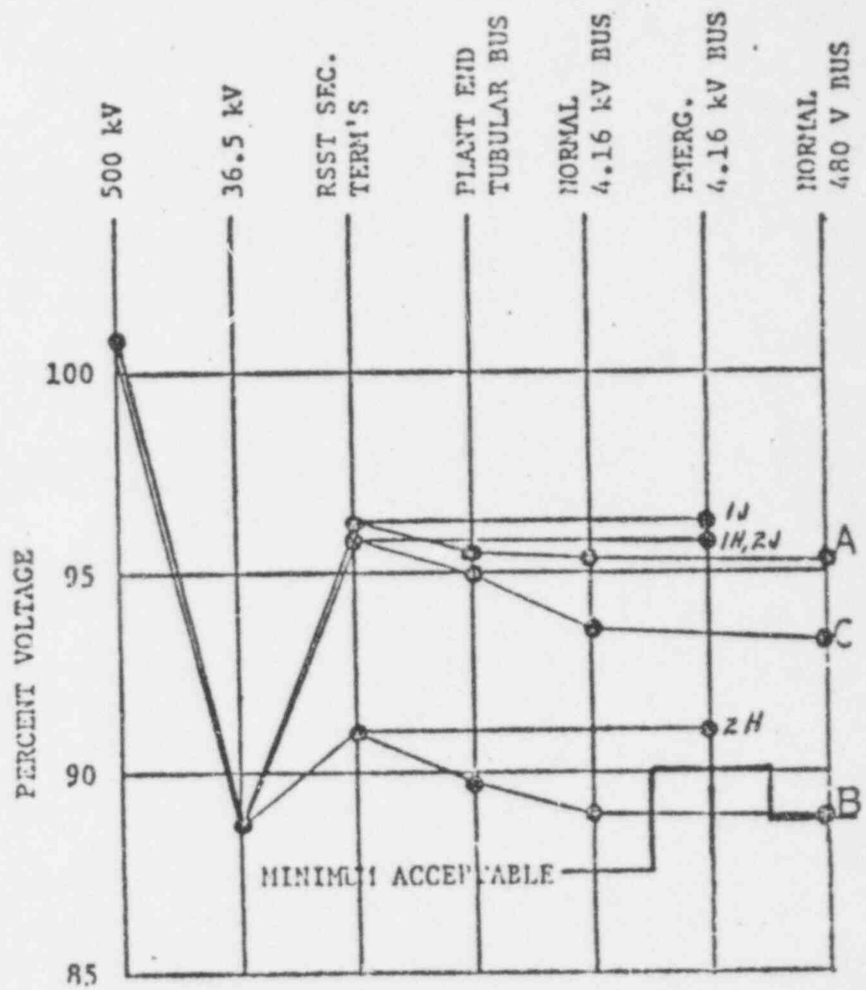
VOLTAGE PROFILE
RESERVE STATION SERVICE TRANSFORMERS
AND CONNECTED BUSES

CASES AP AND AQ



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UNIT	TFMR	FWP	CNP	BCP	SDP HI	SDP LO	RCP	CWP	EM. BUS
STARTUP UNIT 2	A	(△)	(△)		○	○	●		● ↓
	B	(△)	(△)	●	○		●	● ●	↑
	C	●	●		○	○	●	● ●	●
TRIPPED UNIT 1	A	●	●		◎	◎	●		↑
	B	(△◎)	(△◎)	●	◎		●	● ●	● ↓
	C	(△○)	(△◎)		◎	◎	●	● ●	●

CONDITIONS AFTER TRIP - RESERVE STATION SERVICE SYSTEM LOADS

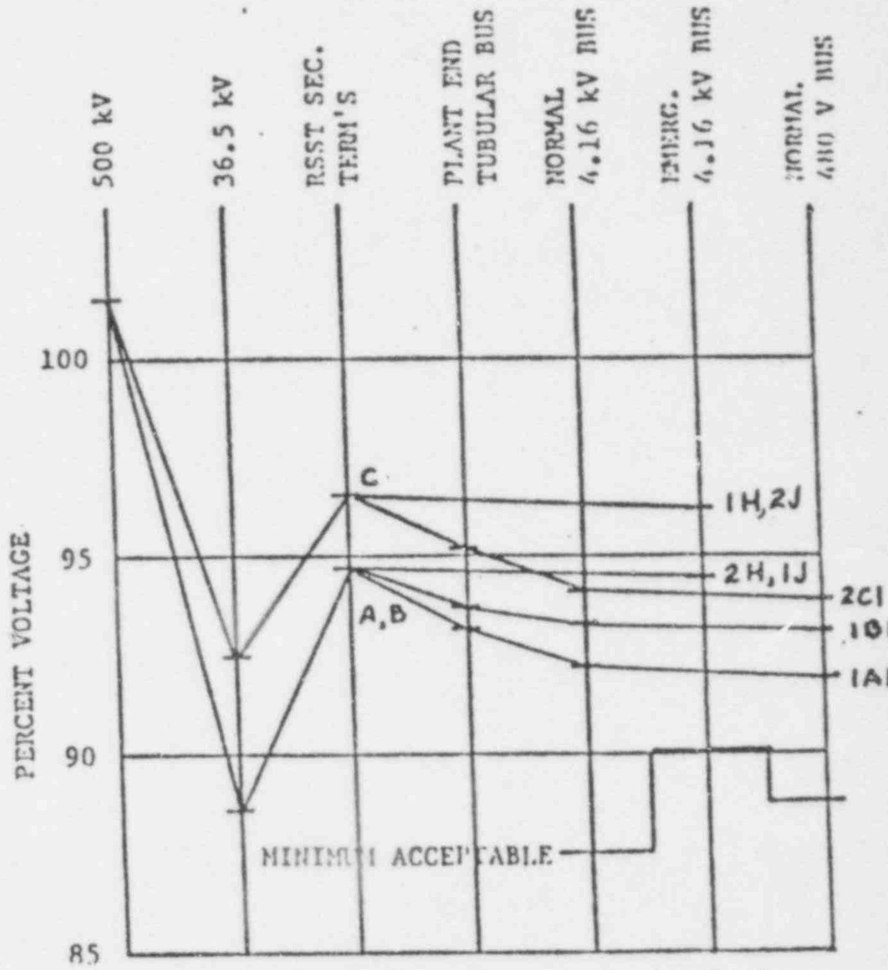
TFMR	% LOAD
A	99.04
B	96.45
C	134.54

Legend

- (blank) NOT RUNNING
- ● RUNNING
- ◎ PREVIOUSLY RUNNING, NOW TRIPPED
- ○ PREVIOUSLY STANDBY, NOW TRIPPED
- △ AUTO START DISABLED AUTOMATICALLY THROUGH OPERATOR-PRESET KEY SWITCHES
- ↑ FED FROM OTHER TRANSFORMER WHEN UNIT 2 IS STARTUP

VOLTAGE PROFILE
RESERVE STATION SERVICE TRANSFORMERS
AND CONNECTED BUSES

CASES AR AND AS



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UNIT	TFMR	FWP	CNP	BCP	SDP HI	SDP LO	RCP	CWP	EM. BUS
STARTUP UNIT 2	A	●	●		○	○	●		● ↓
	B	(△)	(△)	●	○		●	● ●	↓
	C	(△)	(△)		○	○	●	● ●	●
TRIPPED UNIT 1	A	(△)	(⊙△)		⊙	⊙	●		↑
	B	(⊙△)	(⊙△)	●	⊙		●	● ●	●
	C	●	●		⊙	⊙	●	● ●	●

CONDITIONS AFTER TRIP - RESERVE STATION SERVICE SYSTEM LOADS

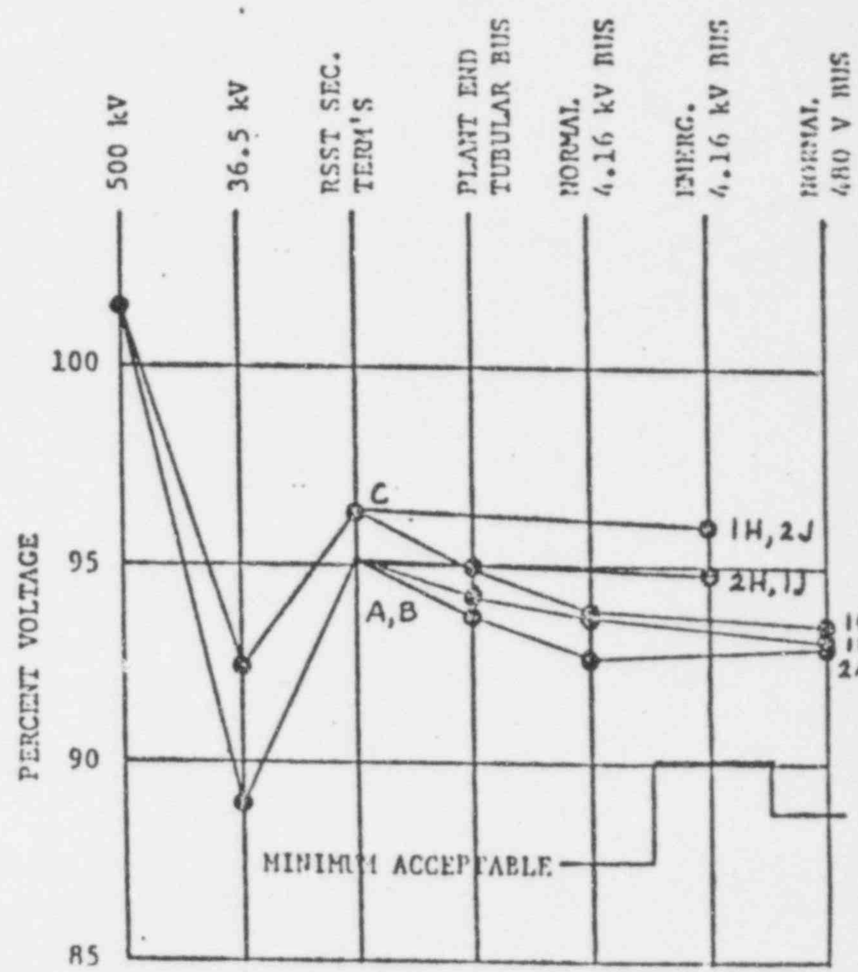
TFMR	% LOAD
A	94.93
B	98.09
C	135.86

Legend

(blank)	NOT RUNNING
●	RUNNING
⊙	PREVIOUSLY RUNNING, NOW TRIPPED
○	PREVIOUSLY STANDBY, NOW TRIPPED
△, (△), (⊙△)	AUTO START DISABLED AUTOMATICALLY THROUGH OPERATOR-PRESET KEY SWITCHES
A ↓	FED FROM OTHER TRANSFORMER WHEN UNIT 2 IS STARTUP

VOLTAGE PROFILE
RESERVE STATION SERVICE TRANSFORMERS AND CONNECTED BUSES

CASES AT AND AU



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Enclosure B

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RUN AW

UNIT 2 - STARTUP AND CDA ("B" PUMPS)

UNIT 1 - TRIP FROM 100% POWER

500 kV BUS AT 517 kV BEFORE

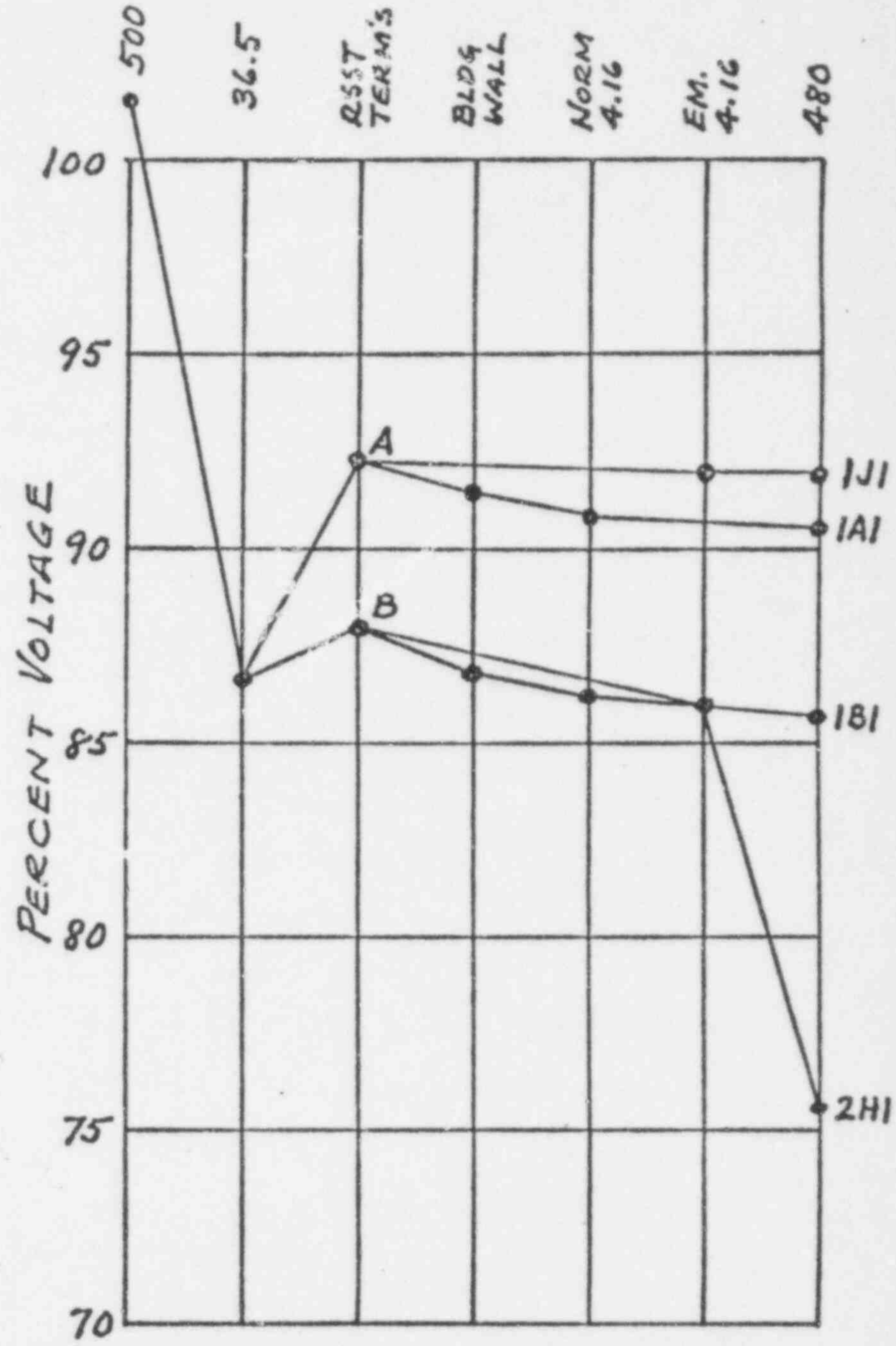
508 kV AFTER

RSST "A" ON LTC TAP R11

RSST "B" ON LTC TAP R16

BOTH ON 35.3 kV PRIMARY TAP

AUTOMATIC LOAD SHED



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CASE BA

UNIT 2 STARTUP ("B" PUMPS)

UNIT 1 TRIP AND CDA

500 kV BUS AT 517 kV BEFORE

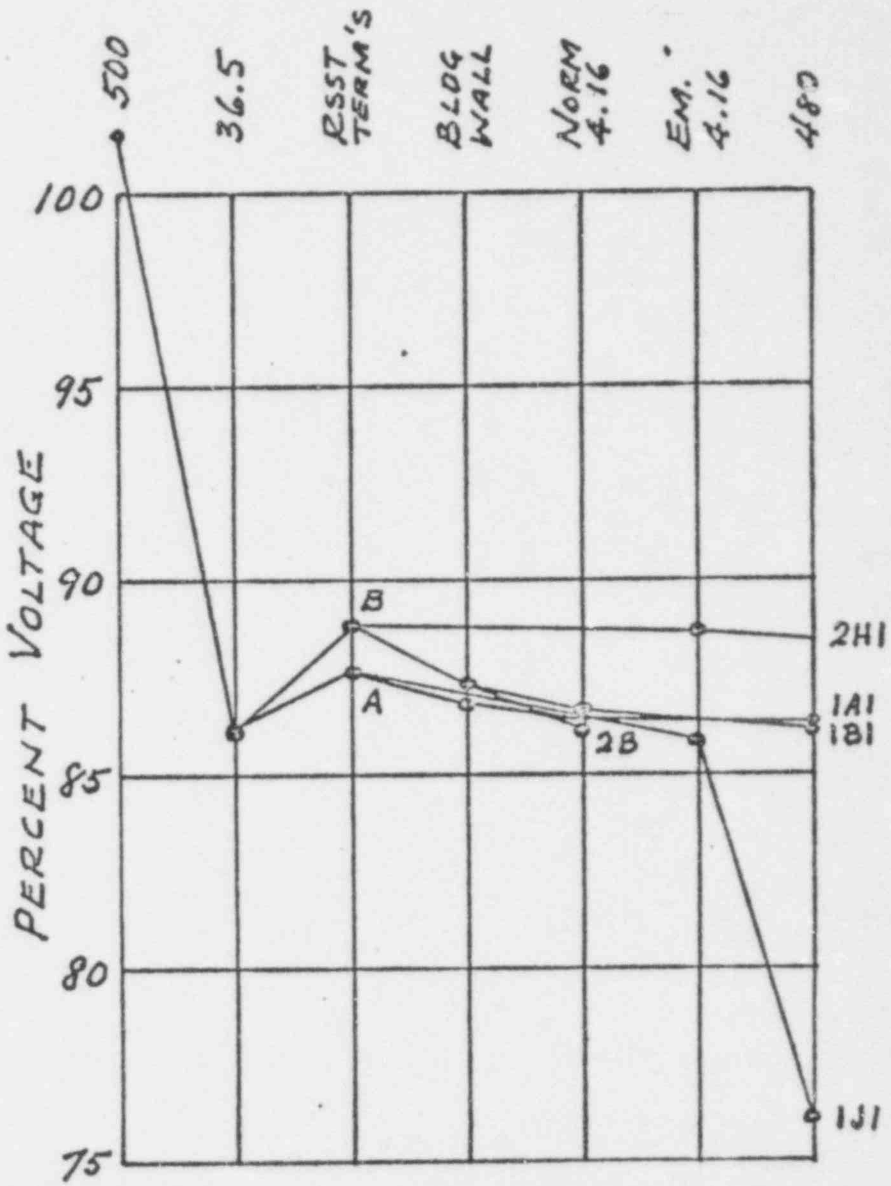
508 kV AFTER

RSST "A" ON LTC TAP R10

RSST "B" ON LTC TAP R16

BOTH ON 35.3 kV PRIMARY TAP

AUTOMATIC LOAD SHED



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Enclosure C

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Enclosure D

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Enclosure E

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GENERAL ELECTRIC

ELECTRIC UTILITY

SALES DIVISION

GENERAL ELECTRIC COMPANY, P. O. BOX 6974, RICHMOND, VIRGINIA 23230
Phone (804) 288-4071

June 8, 1979

Subject: Vepco P.O. #49766
G.E. Reqn. 326-88100
Reserve Station Service
Transformers - North Anna
Power Plant

Mr. John M. Davis
Virginia Electric & Power Company
Post Office Box 26666
Richmond, VA 23261

Dear Mr. Davis:

Our Medium Transformer factory in Rome, Georgia, has analyzed the above referenced transformers to determine the overload capability of the windings and ancillary components.

Specifically, we assumed the transformer had been operating at 75% of maximum rated load for 8 - 12 hours prior to overload, in a 40°C ambient.

We then assumed an emergency occurred and the transformer was loaded to 177% of its maximum nameplate rating for one hour. Under this condition, the top oil reached a temperature of 110.5°C, and the winding hot spot temperature was 139.6°C. The copper lead from the winding to the bushing reached a temperature of 209.8°C.

Based on these temperatures, our computer program predicts a .03% loss of life for the winding and a 10% loss of life for the lead.

If the overload were limited to 156% of maximum nameplate rating for one hour (52.4 MVA), the top oil temperature would reach 100.8°C, the winding hot spot would be 126.2°C, and the lead from the winding to bushing would reach 180°C. These reduced temperatures would cause an insignificant loss of life for the winding and ancillary components.

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GENERAL ELECTRIC

Mr. John M. Davis
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June 8, 1979

Please let me know if further information is needed.

Sincerely,

Ed Summers

Edmund N. Summers
Transmission Equipment
Sales Engineer

/ljl
cc: JC Shaw
MTPD, Rome

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