# REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8012240430 DOC.DATE: 80/12/18 NOTARIZED: NO DOCKET #
FACIL:50-250 Turkey Point Plant, Unit 3, Florida Power and Light C 05000250
50-251 Turkey Point Plant, Unit 4, Florida Power and Light C 05000251

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RECIP.NAME RECIPIENT AFFILIATION
VARGA,S.A. Operating Reactors Branch 1

SUBJECT: Forwards addl info re distribution sys voltages,in response to NRC 800819 ltr.Since safety injection signal initiates automatic fast transfer from auxiliary transformer to startup transformer,only connection via startup analyzed.

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FLORIDA POWER & LIGHT COMPANY

December 18, 1980
L-80-411

Office of Nuclear Reactor Regulation
Attention: Mr S. A. Varga, Chief
Operating Reactors Branch #1
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Varga:

Re: Turkey Points Units 3 & 4
Docket Nos. 50-250 & 50-251
Adequacy of Station
Distribution System Voltages

Florida Power & Light Company's response to a NRC letter dated August 19, 1980, requesting additional information on the above subject is attached.

Very truly yours,

J. A. DeMastry
for
Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/PLP/ras

Attachment

cc: J. P. O'Reilly, Region II
Harold F. Reis, Esquire

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In response to NRC letter to FPL dated August 19, 1980
Re: Request for Additional Information, Turkey Point Units 3 & 4
Adequacy of Station Electric Distribution System (dated July 1, 1980)

Reference: 1) NRC letter to FPL dated August 8, 1979
2) FPL letter to NRC dated November 9, 1979

This response addresses the NRC's request for Additional Information enclosed in the NRC letter to FPL dated August 9, 1980. Clarification of assumptions and specific voltage analysis results are provided herein. Also provided is information requested concerning loading configurations that require greater than the minimum expected steady-state grid voltage in order to start all safety loads simultaneously.

Guideline 1 (Reference 1) requires that separate voltage analyses be performed for each connection to offsite power" ...assuming the need for electric power is initiated by (1) an anticipated transient (e.g. unit trip) or (2) an accident, whichever presents the largest load demand situation." At Turkey Point, the largest load demand situation occurs under an accident condition wherein a safety injection signal starts all safety loads simultaneously. In accordance with Guidelines 3 and 5, all automatic actions by the electrical system are assumed to occur as designed. Therefore, since a safety injection signal initiates an automatic fast transfer from the auxiliary transformer to the start-up transformer, only the connection to offsite power via the start-up transformer was analyzed.

In order to obviate the need to repeatedly calculate the voltage at the terminals of each safety load for each case analyzed, as implied by Guidelines 6 and 7 (Reference 1), FPL chose to calculate the minimum voltage at each bus required to start each safety load. The highest minimum required voltages calculated for each bus are listed in Attachment A. If the voltage analysis results (above) are higher than those minimum values, then sufficient voltage would exist at the terminals of all safety loads to assure their successful start.

The requirements of Guideline 6 (Reference 1) were addressed in the second and third paragraph of page 2 of our November 9, 1979 response (Reference 2). As stated therein, the minimum expected steady-state grid voltage at Turkey Point is 235 KV and the maximum is 244 KV.

All low voltage AC (less than 480V) Class IE busses supplying power to vital instrument or control circuits at Turkey Point are powered by inverters supplied from the 125 VDC batteries. Being independent of offsite power, these busses are not included in the voltage analyses. The heat tracing system is the only safety related equipment powered from busses less than 480V. Since the heat tracing is a purely resistive load, voltage variations will affect the heat output of the system. However, the voltages calculated in the analyses provided herein will have little or no effect on the performance of the heat tracing system because the voltages resulting from these analyses are the worst momentary voltages that could occur upon start of all safety loads simultaneously. As the starting motors accelerate, the voltages would increase. On this basis, voltage variations due to motors starting is not considered to have any adverse impact on Class IE equipment powered from busses less than 480V.

Although Turkey Point is a multi-unit station, the voltages analysis suggested by Guideline 2 (Reference 1) was not performed since the connections to offsite power for Units 3 and 4 are independent of each other and would, therefore, not be different from those provided herein.

In addition to the assumptions contained in the above discussion, the five assumptions listed in our November 9, 1979 response (Reference 2) apply to all cases analyzed. Also, in all cases, no manual load shedding was assumed. In accordance with Guidelines 3 and 5, tripping of the Steam Generator Feedwater Pumps was assumed since this occurs automatically on a Safety Injection Signal. Unique assumptions for each case analyzed involve which Condensate Pumps, Component Cooling Water Pumps, and Intake Cooling Water Pumps are assumed running at the time of the accident. Two out of three of each of these pumps are normally running, but only the A and B pumps receive a start signal on safety injection actuation. This results in various combinations of starting and running loads as reflected in Attachment B. Attachment C provides the results of the voltage analyses for each case on each unit.

In order to provide assurance that no safety loads could experience excessive voltage (Guideline 11, Reference 1) calculations were performed assuming one-half normal load on the 480V busses, minimum pumps running on the 4KV busses, and maximum voltage (244KV) on the grid. The results are presented in Attachment D. Since no calculated voltage is in excesses of 10% of the equipment nameplate (460V or 4000V), the results are considered satisfactory.

In accordance with the subject NRC Request, additional voltage analyses were performed assuming all safety loads have started and are running, and the largest non-Class IE motor is started. (Motor operated valves are assumed to have completed their action). Because the 7000 HP Steam Generator Feedwater Pumps are tripped off on a Safety Injection Signal, it is possible that an operator could re-start a pump after the safety loads are running (although such action in not per procedure) and is not required for safe shutdown). Only two cases for each unit were analyzed:

> Case 2 (Attachment B), which results in the highest load on the "A" train, was assumed when starting the "A" Steam Generator Feedwater Pump.
>
> Case 13 (Attachment B) which results in the highest load on the "B" train, was assumed when starting the "B" Steam Generator Feedwater Pump.

The results of these analyses are tabulated in Attachment E. Also tabulated are the bus voltages required to maintain minimum guaranteed starting voltages at the running safety equipment terminals. (These voltages are based on voltage drops due to full load current. Attachment A voltages are based on voltage drops due to starting currents). Only in the case where the 3B Steam Generator Feedwater Pump is started does an analyzed voltage fall below the required voltage. In this case, MCCD is less than 1.8 volts low. Since the equipment is capable of starting and running at the required voltage, it is reasonable to assume that running equipment will continue to run at the analyzed voltage during the starting of the Steam Generator Feedwater Pump. In any event, the voltages do not decrease sufficiently to cause starters or contactors to drop out. On this basis, the results of these analyses are considered satisfactory.

In order to verify the accuracy of the voltage analyses, voltage and current measurements were made at all Class IE busses. A voltage analyses was then performed using the measured loads and the resulting voltages compared with the measured voltages. The close correlation between the measured and calculated values (less than 3% difference) provides assurance that the mathematical model used in the voltage analyses is accurate.

In response to Items 5 and 6 of the subject NRC request for Additional Information, the loading configurations that require greater than the cases 13 and 14 in Attachment B and result in the calculated bus voltages provided for those cases in Attachment C for Unit 3 only. The operators at Turkey Point have been instructed to avoid operation under these loading configurations. If, due to equipment malfunction, the plant is required to be operated in one of these configurations, the operators have been instructed to ensure that the switchyard voltage remains above that which analyses indicate is sufficient to safely start all safety equipment. If, while operating in one of these loading configurations, the switchyard voltage decreases below the analyzed safe voltage for that configuration, the operators are instructed to decrease the unit's output and thus lower the demand on the electrical system. Such "reduction of loading" as quoted in Item 6 of the subject NRC request does not imply manual load shedding in that no motor or equipment is shutdown. The reduction of load on the electrical auxiliary system is due to lower power required by the various process pumps in the plant. However, as stated in our letter of November 9, 1980, a design modification is in progress to add undervoltage relay protection to the 4160V and 480V load center. This modification will eliminate the need for administrative restrictions on operation of the plant.

In response to Item 4 of the subject NRC request, please refer to our response to NRC letter to FPL dated July 26, 1979 attached to FPL letter to NRC dated November 9, 1979 (Reference 2).

The review requested by Item 2 of the subject NRC request is contained in Chapter 8 of the Turkey Point FSAR.

Attachment A



HIGHEST MINIMUM VOLTAGES REQUIRED TO START SAFETY LOADS

Unit 3

| | |
|---|---|
| 4KV Bus 3A | 3214.4V |
| 4KV Bus 3B | 3213.5V |
| 480V Load Center 3A | None starting |
| 480V Load Center 3B | None starting |
| 480V Load Center 3C | None starting |
| 480V Load Center 3D | None starting |
| 480V MCC 3A | 381.4V |
| 480V MCC 3B | 392.2V |
| 480V MCC 3C | 399.9V |
| 480V MCC 3D | 398.3V |

Unit 4

| | |
|---|---|
| 4KV Bus 4A | 3215.8V |
| 4KV Bus 4B | 3213.4V |
| 480V Load Center 4A | None starting |
| 480V Load Center 4B | None starting |
| 480V Load Center 4C | None starting |
| 480V Load Center 4D | None starting |
| 480V MCC 4A | 402.9V |
| 480V MCC 4B | 396.7V |
| 480V MCC 4C | 393.1V |

Attachment B



LOADING CONFIGURATIONS

In all loading configuration cases listed below, the Safety Injection Pumps and RHR Pumps (1 each per 4KV bus) are assumed to start and the Heater Drain Pumps (1 per bus), Turbine Plant Cooling Water Pumps (1 per bus), circulating Water Pumps (2 per bus), and the Reactor Coolant Pumps (1 on A bus, 2 on B bus) are assumed to be running. The Steam Generator Feedwater Pumps are tripped off upon Safety Injection Signal. The running and starting loads on the 480V load centers and motor control centers do not vary between cases analyzed. The cases listed below apply equally to Unit 3 and Unit 4.

| Case | Condensate Pumps + A | B | C | Comp. Cooling Water Pumps + A* | B* | C | Intake Cooling Water Pumps + A* | B* | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | OFF | RUN | RUN | START | RUN | RUN | START | RUN | RUN |
| 2 | RUN | OFF | RUN | START | RUN | RUN | START | RUN | RUN |
| 3 | OFF | RUN | RUN | RUN | START | RUN | START | RUN | RUN |
| 4 | RUN | OFF | RUN | RUN | START | RUN | START | RUN | RUN |
| 5 | OFF | RUN | RUN | RUN | RUN | OFF | START | RUN | RUN |
| 6 | RUN | OFF | RUN | RUN | RUN | OFF | START | RUN | RUN |
| 7 | OFF | RUN | RUN | START | RUN | RUN | RUN | START | RUN |
| 8 | RUN | OFF | RUN | START | RUN | RUN | RUN | START | RUN |
| 9 | OFF | RUN | RUN | RUN | START | RUN | RUN | START | RUN |
| 10 | RUN | OFF | RUN | RUN | START | RUN | RUN | START | RUN |
| 11 | OFF | RUN | RUN | RUN | RUN | OFF | RUN | START | RUN |
| 12 | RUN | OFF | RUN | RUN | RUN | OFF | RUN | START | RUN |
| 13 | OFF | RUN | RUN | START | RUN | RUN | RUN | RUN | OFF |
| 14 | RUN | OFF | RUN | START | RUN | RUN | RUN | RUN | OFF |
| 15 | OFF | RUN | RUN | RUN | START | RUN | RUN | RUN | OFF |
| 16 | RUN | OFF | RUN | RUN | START | RUN | RUN | RUN | OFF |
| 17 | OFF | RUN | RUN | RUN | RUN | OFF | RUN | RUN | OFF |
| 18 | RUN | OFF | RUN | RUN | RUN | OFF | RUN | RUN | OFF |

\+ Two out of three normally running

* Pumps start automatically on S.I.S. if not already running.

VOLTAGE ANALYSIS RESULTS

CASE 1

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3920 | 3916 |
| 4KV Bus A** | 3811 | 3807 |
| 4KV Bus B* | 3927 | 3935 |
| 4KV Bus B** | 3851 | 3861 |
| 480V LC A | 432 | 417 |
| 480V LC B | 422 | 423 |
| 480V LC C | 419 | 432 |
| 480V LC D | 430 | 428 |
| 480V MCC A | 430 | 411 |
| 480V MCC B | 403 | 415 |
| 480V MCC C | 407 | 430 |
| 480V MCC D | 405 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 2

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3903 | 3898 |
| 4KV Bus A** | 3786 | 3781 |
| 4KV Bus B* | 3944 | 3953 |
| 4KV Bus B** | 3876 | 3888 |
| 480V LC A | 429 | 415 |
| 480V LC B | 425 | 426 |
| 480V LC C | 416 | 430 |
| 480V LC D | 433 | 432 |
| 480V MCC A | 427 | 408 |
| 480V MCC B | 406 | 418 |
| 480V MCC C | 404 | 427 |
| 480V MCC D | 409 | + |

*High - side of current limiting reactor
**Low-side. of current limiting reactor
+Not on Unit 4

# VOLTAGE ANALYSIS RESULTS

## CASE 3

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3953 | 3951 |
| 4KV Bus A** | 3864 | 3862 |
| 4KV Bus B* | 3894 | 3901 |
| 4KV Bus B** | 3797 | 3807 |
| 480V LC A | 438 | 424 |
| 480V LC B | 416 | 417 |
| 480V LC C | 425 | 439 |
| 480V LC D | 423 | 422 |
| 480V MCC A | 436 | 417 |
| 480V MCC B | 397 | 409 |
| 480V MCC C | 413 | 436 |
| 480V MCC D | 399 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

# VOLTAGE ANALYSIS RESULTS

## CASE 4

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3936 | 3933 |
| 4KV Bus A** | 3839 | 3837 |
| 4KV Bus B* | 3911 | 3919 |
| 4KV Bus B** | 3823 | 3833 |
| 480V LC A | 435 | 421 |
| 480V LC B | 419 | 420 |
| 480V LC C | 422 | 436 |
| 480V LC D | 427 | 425 |
| 480V MCC A | 433 | 414 |
| 480V MCC B | 400 | 412 |
| 480V MCC C | 410 | 433 |
| 480V MCC D | 402 | + |

*High - side of current limiting reactor
**Low-side.of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

### CASE 5

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3960 | 3957 |
| 4KV Bus A** | 3872 | 3870 |
| 4KV Bus B* | 3931 | 3939 |
| 4KV Bus B** | 3855 | 3865 |
| 480V LC A | 439 | 425 |
| 480V LC B | 423 | 423 |
| 480V LC C | 426 | 440 |
| 480V LC D | 430 | 428 |
| 480V MCC A | 437 | 418 |
| 480V MCC B | 404 | 416 |
| 480V MCC C | 414 | 437 |
| 480V MCC D | 406 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

### CASE 6

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3943 | 3940 |
| 4KV Bus A** | 3847 | 3844 |
| 4KV Bus B* | 3948 | 3957 |
| 4KV Bus B** | 3880 | 3892 |
| 480V LC A | 436 | 422 |
| 480V LC B | 426 | 426 |
| 480V LC C | 423 | 437 |
| 480V LC D | 434 | 432 |
| 480V MCC A | 434 | 415 |
| 480V MCC B | 406 | 418 |
| 480V MCC C | 411 | 434 |
| 480V MCC D | 409 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

### CASE 7

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3946 | 3943 |
| 4KV Bus A** | 3853 | 3850 |
| 4KV Bus B* | 3901 | 3908 |
| 4KV Bus B** | 3809 | 3818 |
| 480V LC A | 437 | 422 |
| 480V LC B | 418 | 418 |
| 480V LC C | 424 | 437 |
| 480V LC D | 425 | 423 |
| 480V MCC A | 435 | 416 |
| 480V MCC B | 398 | 410 |
| 480V MCC C | 411 | 435 |
| 480V MCC D | 400 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 8

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3929 | 3925 |
| 4KV Bus A** | 3827 | 3824 |
| 4KV Bus B* | 3918 | 3926 |
| 4KV Bus B** | 3834 | 3845 |
| 480V LC A | 434 | 420 |
| 480V LC B | 420 | 421 |
| 480V LC C | 421 | 435 |
| 480V LC D | 428 | 427 |
| 480V MCC A | 432 | 413 |
| 480V MCC B | 401 | 413 |
| 480V MCC C | 409 | 432 |
| 480V MCC D | 404 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

### CASE 9

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3979 | 3978 |
| 4KV Bus A** | 3906 | 3905 |
| 4KV Bus B* | 3867 | 3874 |
| 4KV Bus B** | 3755 | 3764 |
| 480V LC A | 443 | 429 |
| 480V LC B | 411 | 412 |
| 480V LC C | 430 | 444 |
| 480V LC D | 418 | 417 |
| 480V MCC A | 441 | 422 |
| 480V MCC B | 392 | 404 |
| 480V MCC C | 417 | 441 |
| 480V MCC D | 394 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 10

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3962 | 3961 |
| 4KV Bus A** | 3881 | 3880 |
| 4KV Bus B* | 3884 | 3892 |
| 4KV Bus B** | 3780 | 3790 |
| 480V LC A | 440 | 426 |
| 480V LC B | 414 | 415 |
| 480V LC C | 427 | 441 |
| 480V LC D | 422 | 420 |
| 480V MCC A | 438 | 419 |
| 480V MCC B | 395 | 407 |
| 480V MCC C | 415 | 438 |
| 480V MCC D | 397 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

### CASE 11

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3986 | 3984 |
| 4KV Bus A** | 3914 | 3913 |
| 4KV Bus B* | 3905 | 3912 |
| 4KV Bus B** | 3812 | 3822 |
| 480V LC A | 444 | 429 |
| 480V LC B | 418 | 419 |
| 480V LC C | 431 | 445 |
| 480V LC D | 425 | 423 |
| 480V MCC A | 442 | 423 |
| 480V MCC B | 399 | 411 |
| 480V MCC C | 418 | 442 |
| 480V MCC D | 401 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

## CASE 12

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3960 | 3967 |
| 4KV Bus A** | 3888 | 3887 |
| 4KV Bus B* | 3922 | 3930 |
| 4KV Bus B** | 3838 | 3849 |
| 480V LC A | 441 | 427 |
| 480V LC B | 421 | 421 |
| 480V LC C | 428 | 442 |
| 480V LC D | 429 | 427 |
| 480V MCC A | 439 | 420 |
| 480V MCC B | 401 | 413 |
| 480V MCC C | 416 | 439 |
| 480V MCC D | 404 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

# VOLTAGE ANALYSIS RESULTS

## CASE 13

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3949 | 3945 |
| 4KV Bus A** | 3856 | 3852 |
| 4KV Bus B* | 3933 | 3941 |
| 4KV Bus B** | 3857 | 3868 |
| 480V LC A | 437 | 423 |
| 480V LC B | 423 | 424 |
| 480V LC C | 424 | 438 |
| 480V LC D | 431 | 429 |
| 480V MCC A | 435 | 416 |
| 480V MCC B | 404 | 416 |
| 480V MCC C | 412 | 435 |
| 480V MCC D | 406 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

## VOLTAGE ANALYSIS RESULTS

### CASE 14

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3932 | 3928 |
| 4KV Bus A** | 3830 | 3827 |
| 4KV Bus B* | 3950 | 3959 |
| 4KV Bus B** | 3883 | 3895 |
| 480V LC A | 434 | 420 |
| 480V LC B | 426 | 427 |
| 480V LC C | 421 | 435 |
| 480V LC D | 434 | 432 |
| 480V MCC A | 432 | 413 |
| 480V MCC B | 407 | 419 |
| 480V MCC C | 409 | 432 |
| 480V MCC D | 410 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 15

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3982 | 3981 |
| 4KV Bus A** | 3909 | 3908 |
| 4KV Bus B* | 3899 | 3906 |
| 4KV Bus B** | 3803 | 3813 |
| 480V LC A | 443 | 429 |
| 480V LC B | 417 | 417 |
| 480V LC C | 430 | 444 |
| 480V LC D | 424 | 423 |
| 480V MCC A | 441 | 422 |
| 480V MCC B | 398 | 410 |
| 480V MCC C | 418 | 441 |
| 480V MCC D | 400 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 16

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3965 | 3963 |
| 4KV Bus A** | 3883 | 3882 |
| 4KV Bus B* | 3916 | 3924 |
| 4KV Bus B** | 3828 | 3840 |
| 480V LC A | 440 | 426 |
| 480V LC B | 420 | 420 |
| 480V LC C | 428 | 441 |
| 480V LC D | 428 | 426 |
| 480V MCC A | 438 | 420 |
| 480V MCC B | 400 | 412 |
| 480V MCC C | 415 | 439 |
| 480V MCC D | 403 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 17

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3989 | 3987 |
| 4KV Bus A** | 3917 | 3916 |
| 4KV Bus B* | 3936 | 3944 |
| 4KV Bus B** | 3861 | 3871 |
| 480V LC A | 444 | 430 |
| 480V LC B | 424 | 424 |
| 480V LC C | 431 | 445 |
| 480V LC D | 431 | 429 |
| 480V MCC A | 442 | 423 |
| 480V MCC B | 404 | 416 |
| 480V MCC C | 419 | 442 |
| 480V MCC D | 407 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

CASE 18

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 235 KV) | | |
| 4KV Bus A* | 3972 | 3969 |
| 4KV Bus A** | 3891 | 3890 |
| 4KV Bus B* | 3953 | 3962 |
| 4KV Bus B** | 3887 | 3898 |
| 480V LC A | 441 | 427 |
| 480V LC B | 426 | 427 |
| 480V LC C | 428 | 442 |
| 480V LC D | 435 | 433 |
| 480V MCC A | 439 | 420 |
| 480V MCC B | 407 | 419 |
| 480V MCC C | 416 | 439 |
| 480V MCC D | 410 | + |

*High - side of current limiting reactor
**Low-side. of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS

ASSUMING MINIMUM LOAD & MAXIMUM SWITCHYARD VOLTAGE

| | UNIT 3 | UNIT 4 |
|---|---|---|
| BUS VOLTAGES (Grid at 244 KV) | | |
| 4KV Bus A* | 4326 | 4326 |
| 4KV Bus A** | 4312 | 4312 |
| 4KV Bus B* | 4325 | 4328 |
| 4KV Bus B** | 4311 | 4315 |
| 480V LC A | 494 | 494 |
| 480V LC B | 494 | 494 |
| 480V LC C | 494 | 494 |
| 480V LC D | 506 | 498 |
| 480V MCC A | 493 | 493 |
| 480V MCC B | 491 | 493 |
| 480V MCC C | 493 | 493 |
| 480V MCC D | 500 | + |

*High - side of current limiting reactor
**Low-side of current limiting reactor
+Not on Unit 4

VOLTAGE ANALYSIS RESULTS - UNIT 3

ASSUMING SAFETY LOADS RUNNING AND

STARTING OF LARGEST NON-CLASS IE LOAD

| | BUS VOLTAGES (Grid at 235 KV) | | |
|---|---|---|---|
| BUS | REQUIRED | CASE 2 | CASE 13 |
| 4KV Bus A* | NONE | 3537 | 4008 |
| 4KV Bus A** | 3204 | 3492 | 3970 |
| 4KV Bus B* | NONE | 3982 | 3504 |
| 4KV Bus B** | 3204 | 3953 | 3469 |
| 480V LC A | 380 | 397 | 451 |
| 480V LC B | NONE | 448 | 393 |
| 480V LC C | NONE | 396 | 451 |
| 480V LC D | 378 | 456 | 397 |
| 480V MCC A | NONE | 395 | 449 |
| 480V MCC B | 382 | 442 | 387 |
| 480V MCC C | 386 | 393 | 447 |
| 480V MCC D | 385 | 442 | 383 |

*High - side of current limiting reactor
**Low-side of current limiting reactor

VOLTAGE ANALYSIS RESULTS - UNIT 4

ASSUMING SAFETY LOADS RUNNING AND

STARTING OF LARGEST NON-CLASS IE LOAD

| | BUS VOLTAGES (Grid at 235 KV) | | |
|---|---|---|---|
| BUS | REQUIRED | CASE 2 | CASE 13 |
| 4KV Bus A* | NONE | 3518 | 4012 |
| 4KV Bus A** | 3203 | 3474 | 3974 |
| 4KV Bus B* | NONE | 3994 | 3506 |
| 4KV Bus B** | 3204 | 3968 | 3472 |
| 480V LC A | 375 | 393 | 450 |
| 480V LC B | NONE | 450 | 393 |
| 480V LC C | NONE | 396 | 453 |
| 480V LC D | 374 | 456 | 397 |
| 480V MCC A | 388 | 390 | 447 |
| 480V MCC B | 384 | 446 | 390 |
| 480V MCC C | NONE | 394 | 451 |

*High - side of current limiting reactor
**Low-side of current limiting reactor