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TO: MR D L ZIEMANN	FROM: NSP MINNEAPOLIS, MINN L O MAYER
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DESCRIPTION

LTR REF OUR 8-13-76 LTR....RESPONSE TO 8/13/76 NRC LETTER ON QUESTIONS CONCERNING EQUIPMENT PERFORMANCE UNDER DEGRADED GRID VOLTAGE CONDITIONS.....

PLANT NAME: MONTICELLO

ENCLOSURE

ACKNOWLEDGED

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FOR ACTION/INFORMATION ENVIRO 9-22-76 RKB

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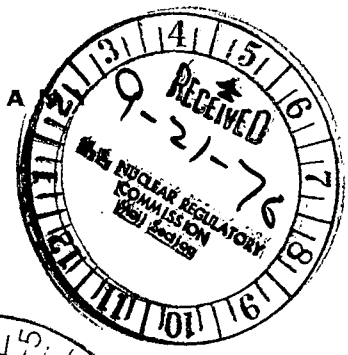


September 17, 1976 Regulatory Docket File

Mr. D. L. Ziemann, Chief
Operating Reactors Branch #2
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Ziemann:

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Response to 8/13/76 NRC Letter on Questions
Concerning Equipment Performance Under
Degraded Grid Voltage Conditions

This letter is in response to the request for information included in your August 13, 1976, letter concerning equipment performance under degraded grid voltage conditions. The responses below are numbered to correspond with the questions included in enclosure 2 of the above referenced letter.

1.a. Plant procedures require transfer of auxiliary power to an off site power source just prior to removing the generator from service. The percentage of plant operating time in which power is supplied by an off site source is therefore essentially the same as the percentage of time that the generator is off line while the reactor is critical. On a cumulative basis this has been 3.45%.

1.b. The normal operating range of the 345 Kv Substation Bus voltage at Monticello is between 354 Kv and 338 Kv.

The normal operating range of the 115 Kv Substation Bus voltage at Monticello is between 125 Kv and 118 Kv.

During operation with 1R transformer supplying station auxiliary loads the voltages at the safety related buses for the above range of 115 Kv Substation voltage will be as follows:

9574

	125 Kv	118 Kv
4.16 Kv Bus 15	4400	4155
4.16 Kv Bus 16	4350	4100
480v L.C. 103	483	458
480v L.C. 104	477	449

1AR Transformer is another source for the safety related buses. The voltages at the safety related buses with 1AR under no load conditions and the range of 345 Kv Substation voltages specified above will be as follows:

	354 Kv	338 Kv
4.16 Kv Bus 15	4210	3995
4.16 Kv Bus 16	4210	3995
480v L.C. 103	486	460
480v L.C. 104	486	460

If 1AR transformer were supplying load to the Safety Related buses, the bus voltages for the above range of 345 Kv Substation voltage with 1AR carrying 7500 Kva would be as follows:

	354 Kv	338 Kv
4.16 Kv Bus 15	4081	3872
4.16 Kv Bus 16	4081	3872
480v L.C. 103	449	422
480v L.C. 104	447	420

1.c. With the station auxiliaries and therefore the safety related buses, supplied by 1R Transformer the lowest voltage will occur on the safety related buses when the 115 Kv Substation voltage is at the minimum normal operating voltage of 118 Kv and 1R Transformer is carrying the station auxiliary load of 32 Mva.

4.16 Kv Bus 15	4155
4.16 Kv Bus 16	4100
480v L.C. 103	458
480v L.C. 104	449

The highest voltage will occur on the safety related buses when the station auxiliaries are supplied by 1R Transformer under no load conditions and the 115 Kv Substation voltage is a maximum normal operating voltage of 125 Kv.

4.16 Kv Bus 15	4629
4.16 Kv Bus 16	4629
480v L.C. 103	534
480v L.C. 104	534

For the case of 1AR Transformer supplying the safety related buses the lowest voltage condition on 4.16 Kv buses will occur with 1AR loaded at 7500 Kva and 345 Kv bus voltage at 338 Kv.

4.16 Kv Bus 15	3872
4.16 Kv Bus 16	3872
480v L.C. 103	422
480v L.C. 104	420

For the other extreme, no load on 1AR and 345 Kv bus voltage as 354Kv:

4.16 Kv Bus 15	4210
4.16 Kv Bus 16	4210
480v L.C. 103	486
480v L.C. 104	486

Our design is presently being analyzed to determine if the voltage profiles at the safety related buses are satisfactory.

1.d. The generator voltage operating range is limited by machine design and therefore operating practice to 22 Kv ± 5%. The station auxiliaries bus voltages are therefore not determined by 345 Kv Substation voltage when the station auxiliary buses are supplied by 11 Station Aux. Transformer. The range of station auxiliary (safety related) bus voltages occurring with 11 station auxiliary transformer carrying 30.4 MVA are as follows:

	23.1 Kv	20.9 Kv
4.16 Kv Bus 15	4350	4040
4.16 Kv Bus 16	4300	3900
480v L.C. 103	480	450
480v L.C. 104	480	442

1.e. There are two loss of voltage trip sensors located on each of the two safety related buses. The trip setpoint for these sensors is 2.625 Kv. The trip setpoint selection was based on the stall voltage of the motors fed by the bus.

1.f. With the station aux. buses supplied by 1R Transformer, the maximum 4.16 Kv and 480v bus voltage will occur with 115 Kv Substation voltage at 125 Kv. The following bus voltages will occur with 1R transformer carrying 32 MVA:

4.16 Kv Bus 15	4400
4.16 Kv Bus 16	4350
480v L.C. 103	483
480v L.C. 104	477

With 1AR supplying the safety related buses the maximum 4.16 Kv and 480v bus volts will occur when the 345 Kv bus is at 354 Kv:

	No Load	Full Load
4.16 Kv Bus 15	4210	4081
4.16 Kv Bus 16	4210	4081
480v L.C. 103	486	447
480v L.C. 104	486	449

The loss of voltage relays are all set to drop out at a 4.16 Kv bus voltage of 2.625 Kv. The corresponding 4.16 Kv and 480v bus voltage at the time of drop out will be:

4.16 Kv Bus 15	2.625 Kv
4.16 Kv Bus 16	2.625 Kv
480v L.C. 103	286 V
480v L.C. 104	287 V

1.g. No station auxiliary motors or contactors will operate correctly at the voltages corresponding to drop out of the loss of voltage relays.

A definition of the voltage range over which the safety related components, and non-safety components can operate continuously in the performance of their design function will be supplied following completion of the analysis discussed in 1.c. above.

1.h. The Operators take a voltage readings of each 4.16 Kv bus (excluding discharge structure buses) every hour from voltage monitors located in the control room. The computer provides an alarm at a high voltage of 4.5 Kv and at a low voltage of 3.8 Kv on any of the 4.16 Kv buses. A trend recorder monitors 345 Kv and 115 Kv bus voltages. An annunciator alarms for loss of voltage in the 345 Kv or 115 Kv Substation. There are also voltage indicators for the main generator, diesel generators and 1AR transformer.

2. The load shedding feature is not maintained after the diesel generators are connected to their safety related buses.

3. There is no grid stability analysis cited in the FSAR, however the following operating limits have been established:

   a. Real & reactive power - see attached figure.

   b. Generator voltage - 22 Kv $\pm$ 5%.

   c. Frequency - underfrequency trip at 58.5 hertz.

Operating procedures outline these limits and provide instructions for making necessary adjustments.

4. A description of any proposed actions or modifications to our facility will be provided following completion of the analysis discussed in 1.c. above.

Yours very truly,

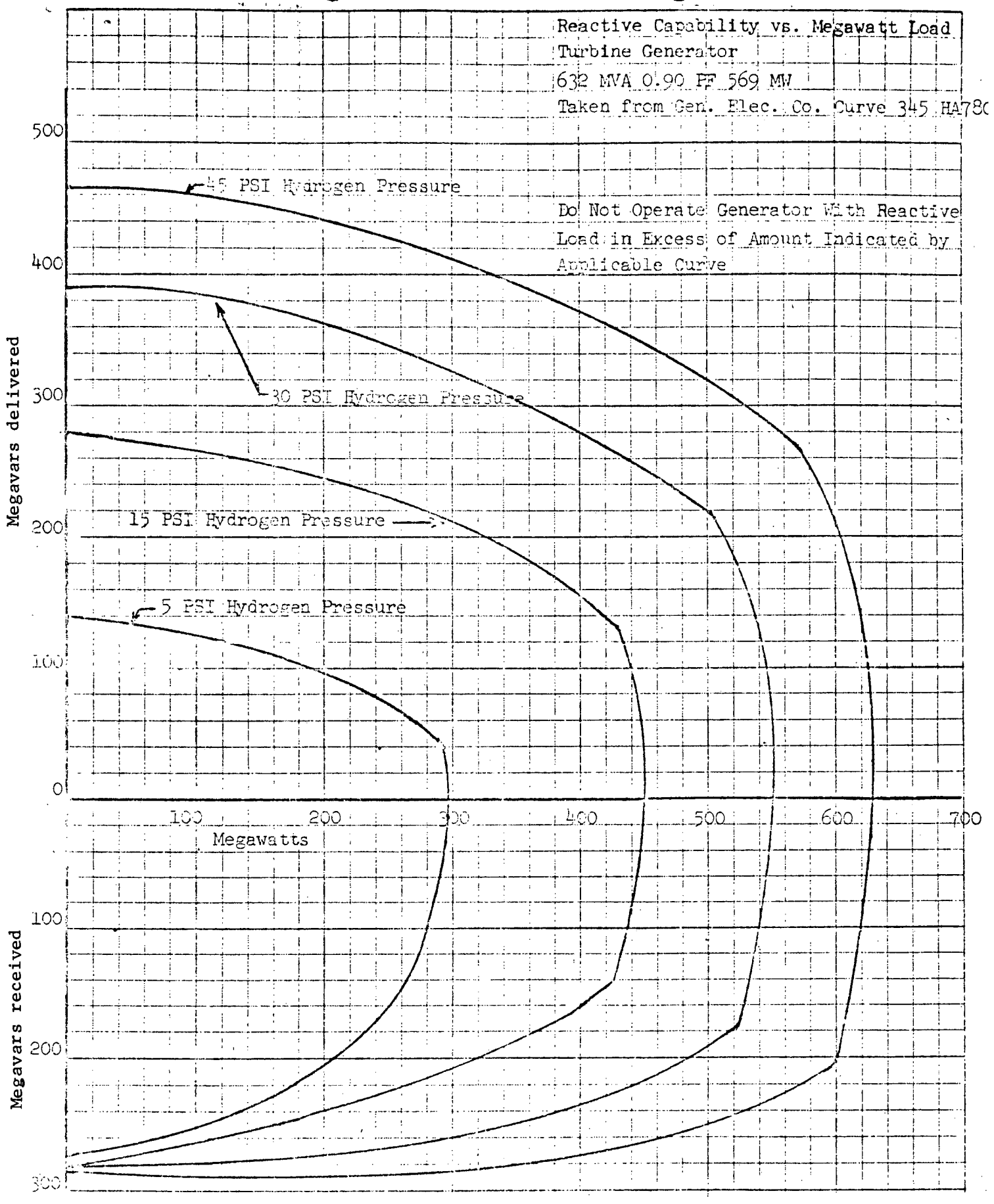
L. O. Mayer

L. O. Mayer, PE
Manager, Nuclear Support Services

LOM/sdd

Attachment

cc: J. G. Keppler
G. Charnoff
MPCA
Attn: J. W. Ferman



Generator Real and Reactive Power Operating Limits