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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards revised response to FSAR Question 430.8 re degraded voltage condition & undervoltage relays.

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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

October 10, 1984
(NMP2L 0191)

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Nine Mile Point Unit 2
Docket No. 50-410

Dear Mr. Schwencer:

Enclosed for your use and information is the Nine Mile Point Unit 2 revised response to a Nuclear Regulatory Commission's Final Safety Analysis Report question. This information has been previously discussed with your staff and is submitted to aid your review of the Unit 2 license application for the resolution of this question. This submittal includes response to question 430.8.

The enclosed will be included in the next Final Safety Analysis Report Amendment.

Very truly yours,

CVMangan

C. V. Mangan
Vice President
Nuclear Engineering & Licensing

NLR:ja
Enclosure
xc: Project File (2)
R. Gramm, NRC Resident Inspector

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of Niagara Mohawk Power Corporation (Nine Mile Point Unit 2)	)))))	Docket No. 50-410

AFFIDAVIT

C. V. Mangan, being duly sworn, states that he is Vice President of Niagara Mohawk Power Corporation; that he is authorized on the part of said Corporation to sign and file with the Nuclear Regulatory Commission the documents attached hereto; and that all such documents are true and correct to the best of his knowledge, information and belief.

CVMangan

Subscribed and sworn to before me, a Notary Public in and for the State of New York and County of Onondaga, this 10 day of October, 1984.

Janis M. Macro
Notary Public in and for
Onondaga County, New York

My Commission expires:
JANIS M. MACRO
Notary Public in the State of New York
Qualified in Onondaga County No. 4784555
My Commission Expires March 30, 1985

QUESTION F430.8 (SRP Appendix 8A)

Regarding the degraded voltage condition and undervoltage relays discussed in FSAR Section 8.2.2:

a. You state that 517.5 V (90 percent of the motor nameplate voltage of 575 V) is required at the 600 V buses to ensure proper starting and running of all Class 1E motors. Since 90 percent is the motor rated voltage for continuous operation, the additional voltage drop from the 600 V buses to the motor terminals will result in the motors operating at less than their continuous rated voltage. Justify this condition. Likewise, justify the capability to start 80% rated NSSS and MOV motors with only 80% of the motor rated voltage up at the buses.

b. You state that from the voltage profile study the grid voltage needed to maintian adequate station voltages at the lowest tap of the load tap changer (LTC) is below the normal operating range of the grid. Is this the worst case condition? Since the sensing for the LTC is on the 13.8 KV system, is there a lightly loaded 13.8 KV condition which would result in the LTC being on a higher tap and consequently worse 4.16 KV voltages? Also, provide the results of your analysis for the opposite condition, i.e., heavily loaded 13.8 KV system and lightly loaded 4.16 KV system resulting in 4.16 KV system overvoltages.

c. You state that when the auxiliary boiler transformer is supplying the onsite emergency power distribution system and the grid is at its normal operating minimum, the voltage at the 600 V buses under the most severe load conditions is 460 V (80 percent of 575 V). Per the discussion in item (a) above justify the capability to start NSSS and MOV motors and to operate continuously all Class 1E motors at this low voltage.

d. Extend your analysis to include all Class 1E equipment (not just motors) down to the 120/208 and 120/240 volt levels, and provide the Class 1E bus voltage profiles for steady state and transient conditions.

e. Provide a detailed description of your second level undervoltage relay design, including setpoints; and address each position of SRP Branch Technical Position PSB-1.

RESPONSE

See revised Section 8.2.2.

tem voltage fluctuations of 120.75 kV (105 percent) to 109.25 kV (95 percent) and secondary load fluctuations. The 4.16-kV tertiary winding voltage fluctuates in accordance with the foregoing selected tap position, primary voltage variation, and/or 4.16-kV emergency switchgear bus load condition.

The minimum starting voltage for all Class 1E motors, except NSSS motors and MOVs, is 75 percent of the motor nameplate voltage. The minimum starting voltage for all NSSS motors and MOVs is 80 percent of the motor nameplate voltage. All Class 1E motors are capable of running at the minimum voltage of 90 percent of the motor nameplate voltage.

The maximum permissible voltage drop between any 4.16-kV emergency bus and the 4.16-kV connected loads under normal running condition is 20 V, while that during motor starting is 60 V. The maximum permissible voltage drop between the 600-V emergency load center buses and their connected loads under normal operating conditions is 12 V (for the motor control centers, this is broken up as 4 V between the load center and the motor control center, and 8 V between the motor control center and the motors). However, for MCC feeders having longer cable lengths, voltage drops from 600-V load centers to the MCC and from the MCC to the motor are redistributed within the framework of the total voltage drop limitation of 12 V.

The voltage profile study of the plant electrical power distribution system has been performed using the permissible voltage drops previously stated. This study shows that the minimum voltage to ensure proper starting of all Class 1E motors at 4.16 kV, as well as 600-V buses, is 460 V at 600 V motor terminals (80 percent of the motor nameplate voltage of 575 V) during the most severe motor starting condition with 4.16-kV and 600-V buses fully loaded. The minimum voltage that will ensure proper running of all Class 1E motors at 4.16 kV as well as 600-V buses is 517.5 V at the 600-V motor terminals (90 percent of the motor nameplate voltage of 575 V) under full load conditions of 4.16 kV and 600-V buses.

From the voltage profile study for the reserve station service transformers, it is observed that the minimum 115-kV system voltage that will satisfy the preceeding conditions of minimum voltages is 107.8 kV (93.74 percent of 115 kV) under the worst loading conditions, i.e., when the 13.8-kV buses are unloaded, and the 4.16-kV buses are loaded fully. This voltage (107.8 kV) is less than the minimum 115-kV system voltage of 109.25 kV (95 percent of 115 kV). Under

the opposite conditions, i.e., when the 13.8-kV buses are heavily loaded and the 4.16-kV buses are lightly loaded with the 115-kV system operating at the minimum (109.25 kV), voltage at the 4.16-kV load terminal will be 4.328 kV (108.2 percent of the motor nameplate voltage of 4 kV). This is within 10 percent of the motor nameplate voltage.

From the voltage profile study for the auxiliary boiler transformer, it is observed that when the auxiliary boiler is feeding any 4.16-kV bus, the minimum 115-kV system voltage that will ensure at least 80 percent of the motor nameplate voltage at the motor terminals during starting condition and 90 percent of the motor nameplate voltage at the motor terminals during normal running condition for 4.16-kV as well as 600-V levels is 109.25 kV (95 percent of 115 kV), which is within the operating limits of the 115-kV system.

When the 4.16-kV emergency buses (Divisions I and II) are fed from the emergency diesel generators, the minimum voltages at the 4.16-kV loads under the most severe starting condition and the normal running condition will be 3,268 V (81.7 percent of the nominal load terminal voltage of 4000 V) and 3921 V (98 percent of 4000 V), respectively; the minimum voltages at the 600-V loads under the most severe starting condition and the normal running condition will be 461 V (80.2 percent of the nominal load terminal voltage of 575 V) and 517.5 V (90 percent of 575 V), respectively.

The minimum voltage that will ensure proper operation of all Class 1E control and other loads at 120-V ac level are as follows:

a. The minimum pickup voltage for all starters is 77-V ac (70 percent of the rated coil voltage of 110-V ac).

b. The minimum voltage for all other control devices, including MOVs and SOVs, is 96 V (80 percent of 120 V).

All 600-V cables feeding 600 V-120/208-V transformers and 120-V cables are sized to ensure the minimum voltages shown above for 120-V loads at the 120-V load terminals assuming the minimum voltage (477 V, the worst voltage condition during motor starting) at the 600-V load centers.

The minimum 125-V dc voltage that will ensure proper operation of all Class 1E dc loads are as follows:

a. The minimum operating voltage for all Division I and II dc loads is 101 V (SOVs, MOVs, etc).

b. The minimum operating voltage for all Division III dc loads is 110 V (SOVs and MOVs).

All 125-V dc cables are sized to maintain these minimum voltages at the 125-V load terminals, assuming the battery terminal voltage at the minimum of 105 V for Divisions I and II, and 112.5 V for Division III, except in cases where the device (relay trip coils and closing coils) is capable of operating at levels below 101 or 110 V, when the cables are sized to maintain these minimum voltages.

The minimum voltages at the various buses and their connected loads under different loading conditions are summarized in Table 8.2-1.

Two levels of undervoltage protection are provided at the 4.16-kV emergency buses: one to detect loss of offsite power, and one to detect degraded voltage conditions. The loss of offsite power relay is set to trip the offsite power supply breaker, alarm the control room, and initiate emergency diesel generator starting when the 4.16-kV bus voltage drops to 3212.86 V, which corresponds to 475.5 V at the 600-V buses. The time setting is 3.0 sec.

The degraded voltage relay is set at 3607.76 V, which corresponds to 533.69 V at the 600-V buses. This is provided with two time delays. The first time delay is at 8 sec. Following this time delay, the degraded voltage condition is alarmed in the control room under normal plant operating conditions. Under accident conditions, the offsite power supply breaker will trip, and the emergency diesel generator will start following this time delay. The second time delay is set at 30 sec. Following this time delay, the degraded voltage condition will be alarmed in the control room, the offsite power supply breaker will trip, and the emergency diesel generator will start under normal plant operating conditions.

The setting of the loss of offsite power relay (3212.86 V) is below the minimum voltage at the 4610-V bus (3268 V, Divisions I and II) under the worst case starting condition when fed from the emergency diesel generators, so that this relay will not trip during load sequencing.

The undervoltage protection scheme uses coincident logic (two out of three phases) to preclude spurious trips of the offsite power sources. The relays and other devices

associated with the undervoltage protection scheme are Class 1E and are located on the respective Class 1E switchgear.

Stability Considerations

The designs and operation of the interconnected power system must be such that system and generator unit stability will

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TABLE 8.2-1

MINIMUM VOLTAGES AT VARIOUS EMERGENCY BUSES AND THEIR CONNECTED LOADS UNDER DIFFERENT LOADING CONDITIONS

Item	Required Minimum Voltage (volts) Steady-State	Required Minimum Voltage (volts) Transient	Actual Voltage Level: Reserve Transformer 106.07% (122.0 kV)→95% (109.25 kV) Steady-State	Reserve Transformer Transient	Auxiliary Boiler Transformer 106.07% (122.0 kv) →95% (109.25 kV) Steady-State	Auxiliary Boiler Transformer Transient	Diesel Generator 100% (4.16 kV)→ 94.26% (3.921 kV) Steady-State	Diesel Generator Transient	Remarks
1. 4.16 kV Bus									
SWG101, light load	-	-	4112	-	4396	-	4160	-	
SWG101, max load	-	-	4256	3628	3780	3448	3941	3328	
SWG101, partial load	-	-	4012	-	3852	3664	-	-	
SWG102, light load			4112	-	Not Applicable		See FSAR Sec. 8.3.1.1.2		SWG102 can be energized only from reserve xfmr or HPCS diesel generator.
SWG102, max load			4256	3628					
SWG102, partial load			4012	-					
SWG103, light load	-	-	4112	-	4396	-	4160	-	
SWG103, max load	-	-	4256	3628	3780	3448	3941	3328	
SWG103, partial load	-	-	4012	-	3852	3664	-	-	
2. 4.16 kV Load	3600	3200							
SWG101, light load			4092	-	4376	-	4160	-	
SWG101, max. load			4236	3568	3760	3388	3921	3268(1)	
SWG101, partial load			3992	-	3832	3604	-	>3268	
SWG102			Same as Above		Not Applicable		See FSAR Sec. 8.3.1.1.2		
SWG103			Same as Above		Same as Above		Same as Above		
3. 600-V Load Centers US1 and US3	-	-							
Light load	-	-	638	-	553	-	615(2)	-	SWG102 does not have any load center.
Max load			541.5	500	504	-	529.5	477	
Normal load			-	511	516	477	>529.5	489	

TABLE 8.2-1 (Cont)

Item	Required Minimum Voltage (volts) Steady-State	Required Minimum Voltage (volts) Transient	Actual Voltage Level: Reserve Transformer 106.07% (122.0 kV)→95% (109.25 kV) Steady-State	Reserve Transformer Transient	Auxiliary Boiler Transformer 106.07% (122.0 kv) →95% (109.25 kV) Steady-State	Auxiliary Boiler Transformer Transient	Diesel Generator 100% (4.16 kV)→ 94.26% (3.921 kV) Steady-State	Diesel Generator Transient	Remarks
4. 600-V Load (motors connected directly to load centers)	517.5	460							
Light load			626	-	541	-	603	-	
Max load			529.5	482	492	-	517.5	461	
Normal load			-	493	504	461	>517.5	472	
5. 600-V Motor Control Centers MCC101, 102, 103, 301, 302 and 303	-	-							
Light load			534	-	549[3]	-	611[3]	-	
Max load			537.5	500[4]	500[3]	-	525.5[3]		516
Normal load			-	511[4]	512[3]	477	>525.5[3]		527
MCC201					Not Applicable				SWG102 can be energized only from reserve xfmr or from HPCS diesel generator.
Light load			638	-			614	-	
Max load			576	560			577	558	
Normal load			579	563			-	561	
6. 600-V Load (motors Connected to MCC)	517.5	460							
Light load			626	-	541	-	603	-	
Max load			529.5	482[4]	492	-	517.5	496	
Normal load			-	493[4]	504	461[4]	>517.5	507	
MCC 201					Not Applicable				
Light load			626	-			602	-	
Max load			564	548			565	546	
Normal load			567	551			-	549	

TABLE 8.2-1 (Cont)

Item	Required Minimum Voltage (volts) Steady-State	Required Minimum Voltage (volts) Transient	Actual Voltage Level: Reserve Transformer 106.07% (122.0 kV)→95% (109.25 kV) Steady-State	Reserve Transformer Transient	Auxiliary Boiler Transformer 106.07% (122.0 kv) →95% (109.25 kV) Steady-State	Auxiliary Boiler Transformer Transient	Diesel Generator 100% (4.16 kV)→ 94.26% (3.921 kV) Steady-State	Diesel Generator Transient	Remarks
7. 120-V AC Loads									
Main plant computer	110		All 600-V cables feeding 600-120/208-V transformers and 120-V cables are sized to ensure the minimum voltages for each load terminal, assuming the minimum voltage (477 V; worst condition during motor starting condition, refer to Item 3) at the 600-V load center bus.						
Other computers	105								
Isolator	100								
MOV and SOV	96								
Starter	77								
Heater	-								
Light	-								
Motors (90% of motor nameplate voltage)	108								
8. 125-V DC Loads									
MOV and SOV	101		All 125-V dc cables are sized to maintain at least the minimum voltages at the 125-V load terminals, assuming the battery terminal voltage is 105-V for Divisions I and II and 12.5-V for Division III.						

NOTES:

1 The computer program assumes a 20-V drop from the 13.8-kV and/or 4.16-kV switchgear to the connected load during the steady-state condition and a 60-V drop during the motor starting condition (transient).

2 $V_2 = 4.16\ kV\ \left(\frac{600V}{4.056\ kV}\right) = 615V$; 4.056 kV is the tap voltage.

3 The computer program assumes a 12-V drop from 600-V load centers to connected loads during the steady-state condition. For motor control center loads, it is assumed that this voltage drop (12-V) is divided as follows: 4-V drop from the load center to the MCC, and 8-V drop from the MCC to connected loads. However, for MCC feeders with longer cable lengths, the voltage drops from 600-V load centers to the MCC and from the MCC to the motors are redistributed within the framework of the total voltage drop limitation of 12-V.

4 The starting voltage drop at motor terminal, MCC, and load center is dependent upon the cable size and length (cable impedance) and motor hp. Since the load center feeds motor loads from >50 to 200 hp and the MCC feeds motor loads from 1/2 to 50 hp, it is assumed that the transient volt drop at the MCC or motor terminals is equal to the worst case when starting the largest motor on the load center (180 hp).