March 20, 1985

Docket No. 50-263

Mr. D. M. Musolf
Nuclear Support Services Department
Northern States Power Company
414 Nicollet Mall - 8th Floor
Minneapolis, Minnesota 55401

Dear Mr. Musolf:

On November 27, 1984, we issued Amendment No. 31 to Facility Operating License No. DPR-22 for the Monticello Nuclear Generating Plant. The supporting Safety Evaluation on page 2 has subsequently been revised to include clarifying information provided in a letter dated December 27, 1984 from Northern States Power Company.

For your convenience we are reissuing the Safety Evaluation in its entirety with a revised page 2.

Sincerely,

Original signed by/

Vernon L. Rooney, Project Manager
Operating Reactors Branch #2
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

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Mr. D. M. Musolf
Northern States Power Company
Monticello Nuclear Generating Plant

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 31 TO FACILITY OPERATING

LICENSE NO. DPR-22

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

1.0 INTRODUCTION

By letters dated July 27, 1984, with clarifying information presented by letters dated September 25, 1984 and October 25, 1984, Northern States Power Company (NSP/the licensee) proposed revised Technical Specifications (TSs) associated with the degraded grid voltage system. The proposal stemmed from a special investigation by the NRC staff into the circumstances surrounding a spurious actuation of the degraded voltage protection logic at the Monticello Nuclear Generating Plant on August 1, 1983. The investigation was described in a letter to NSP from the NRC staff dated September 8, 1983. The licensee, was requested, as a result of this investigation, to perform a reanalysis of station electric distribution system voltages, implement necessary operating procedures to maintain adequate grid and bus voltages, propose design changes if necessary, and provide appropriate Technical Specifications.

The above investigation revealed that under the plant normal operation and certain loading conditions when station auxiliary loads are supplied via the main generator and the Unit Auxiliary Transformer No. 11 (UAT No. 11), the voltage at Class 1E buses is inadequate and can cause a spurious actuation of the degraded voltage protection logic. Therefore, as an interim measure NSP was requested to supply the station auxiliary loads via the preferred offsite power source, Transformer 1R, until necessary reanalysis was performed and adequate procedures were implemented to ensure that voltage at Class 1E buses would be within the safety equipment ratings when these buses were supplied via the main generator and UAT No. 11.

By letters dated December 30, 1983, July 27, 1984, September 25, 1984 and October 25, 1984, NSP provided the results of the distribution voltage reanalysis and verification tests. In addition, in the above letters, NSP proposed design changes and associated Technical Specifications.

2.0 SYSTEM DESCRIPTION

During normal plant operation, power to station auxiliary loads is provided via main generator and UAT No. 11. During startup, shutdown, and refueling modes of operation, power to auxiliary loads is provided via Reserve

Station Auxiliary Transformer 1R (RSAT1R). In addition to the above offsite sources, Class 1E buses can be supplied via Reserve Station Auxiliary Transformer 1AR (RSAT1AR), the third source of offsite power. However, due to the limited capacity of RSAT1AR, nonsafety buses cannot be supplied via this source.

The primary coil of RSAR1R is connected to the 115 kV grid. The primary coil of RSAT1AR is connected to the 13.8 kV tertiary winding of the 345/115 kV low tab change transformer No. 10. The output of the main generator is connected to the 345 kV grid via a step-up transformer. Prior to the August 1, 1983 incident, the degraded grid voltage relays at the Monticello Nuclear Plant were designed to transfer the station auxiliary loads from UAT No. 11 or RSAT1R directly to emergency diesel generators (EDGs). The above design did not incorporate provisions for transfer to alternate offsite sources (e.g., UAT No. 11 to RSAT1R or RSAT1R or RSAR1AR). Following the above incident, NSP was requested by the NRC to evaluate alternate offsite source transfer prior to transfer to the EDGs, and to make necessary changes to the degraded grid voltage protection logic to incorporate such transfers, if the evaluation supported such changes. The licensee's evaluation concluded that the above transfer scheme is advantageous; and the licensee had modified the degraded grid voltage protection logic accordingly to accommodate such transfers. Under the modified scheme, under nondegraded voltage conditions the transfer sequence of the safety buses is from UAT to RSAR1R to RSAT1AR and to EDGs. Under degraded voltage conditions, however, the safety buses will transfer to RSAT1AR if it has been determined within 5 seconds that voltage at this source is adequate. With the absence of adequate voltage at RSAT1AR the safety buses will be transferred to EDGs after a total time delay of 10 seconds. By a letter dated December 27, 1984, NSP, stated that the above time delay is consistent with the time delay assumed in the accident analysis. Since the degraded grid voltage relay actuation during the August 1, 1983 incident occurred while the auxiliary loads were being supplied via UAT No. 11, it was recommended by the NRC to supply the above loads via RSAR1R during normal plant operation until necessary analysis was performed to determine the suitability of the UAT No. 11 to supply those loads under minimum main generator output voltage condition. The licensee has complied with the above recommendation.

3.0 EVALUATION

By letters dated December 30, 1983 and September 25, 1984, NSP provided the results of the reanalysis of station electric distribution system voltages. The computer model used in the reanalysis established the following acceptable high and low operating voltage levels:

OPERATING RANGES

	Hi	Lo
115 kV	122	117.5
345 kV	362	342
Generator Terminal kV	22.5	21.3
4.16 kV Bus	4375	3989

The licensee stated that if the voltages are maintained within the above operating ranges, adequate voltages will be provided to all safety loads including those supplied by the 120 volt instrument buses under the worst case conditions analyzed.

The voltage reanalysis used the following listed assumptions in order to establish maximum and minimum coincident load demands:

- For continuous running motors actual measured currents were used. IF these currents were not available, calculated horsepower or nameplate currents were used.

- Measured currents were used for lighting. If these currents appeared low compared to the supply transformer rated current, 80% of the rated transformer current was used.

- A demand factor reflecting the operating horsepower was used where redundant or multiple motors are provided. For example, if there are two full capacity pumps and only one is normally operating, a demand factor of 0.5 was used. A demand factor of 0.25 was used for intermittent loads such as sump pump, reactor water clean-up precoat pump (RWCPP). The RWCPP is operated approximately one hour each week. Therefore, one fourth of the full load current was added as the continuous load contribution to its respective motor control center (MCC).

- Cooling load was used for the maximum load analysis and heating load was used for the minimum load analysis.

- Due to the negligible load contribution of motor operated valves (8.9 HP and 57.7 HP on MCCs 133 and 143, respectively), these loads were excluded for both transient and steady state reanalysis.

The above assumptions resulted in total calculated coincident load demand of 29 MW. However, the actual measured 100% house load is 27 MW. This indicated that the above listed assumptions are conservative.

Acceptable minimum voltage for Class 1E buses which would provide minimum allowable voltage on the 120 V instrument buses under full station auxiliary loads and emergency core cooling system (ECCS) actuation was determined to be 3897 volts (93.7% of 4160 volts). Acceptable voltage limits on the essential 120 V ac instrument panels was established as 120 V ± 10% based on typical vendor specifications. No cable voltage drops for instrument circuits were assumed due to light loads on these circuits. Acceptable maximum and minimum voltage limits on the 480 V MCCs were determined as 496 V (112.7% of 440 V motors) and 426 V (92.6% of 460 V motors) respectively, allowing approximately 2.5% for cable drop.

NSP stated that previous testings have shown that motor starters will operate satisfactorily under the minimum MCCs voltage.

The reanalysis modeled various cases in the computer program for both steady-state and transient conditions, using UAT No. 11, RSAT1R and RSAT1AR each separately as the supply source. Review of the voltage reanalysis results indicate that all safety equipment will be supplied with voltages within the equipment nameplate ratings under the conditions analyzed when generator, grid, and bus voltages are maintained within the operating limits established and is therefore acceptable. In addition, the reanalysis shows that adequate voltages will be provided to safety equipment when these equipment are supplied via the main generator and UAT No. 11 if the generator output voltage is maintained within the operating limits. We, therefore, find the transfer of the station auxiliary loads to UAT No. 11 under plant normal operation acceptable.

By letter dated October 25, 1984, NSP provided the results of tests conducted to verify the accuracy of the voltage reanalysis. We have reviewed the tests results and find that the assumptions used in the voltage reanalysis closely correlate with actual plant values and are therefore acceptable.

Case 1 of the voltage reanalysis was run to determine the grid voltage which would result in the minimum acceptable voltage limit on the 4.16 kV safety buses 15 and 16. This was accomplished by using Transformer 1R as the supply source with loss-of-coolant accident (LOCA) loads under steady-state condition. Then, the grid voltage was lowered to 113.3 kV at which time the safety bus 15 was at 3897 volts, the minimum acceptable voltage. At this voltage all safety equipment are provided with adequate voltages. As it is shown in the Case 1 analysis, in order for the voltage to drop to the minimum acceptable limit, the grid voltage must fall below its minimum established operating limit (117.5 kV). The degraded grid relay setpoint was then established by adding the relay tolerance (± 18 volts) to 3897 volts to compensate for the relay drift in the negative direction (3897 + 18 = 3915 V). In order to ensure that the relay will reset after voltage is recovered for transient conditions lasting less than the time delay allowed by the relay (10 ± 1) seconds, the relay tolerance was added again to compensate for the relay drift in the positive direction. Finally the relay reset band (42 volts) was added to determine the reset voltage, 3975 volts (3915 + 18 + 42). Therefore, any transient condition which results in a voltage recovery to 3975 volts or greater in less than 9 seconds will not result in actuation of the degraded grid voltage protection logic.

By letters dated July 27 and September 25, 1984, NSP provided the design details, and necessary Technical Specifications including limiting conditions for operation associated with the degraded grid voltage protection system. The loss-of-voltage sensors on each 4.16 kV safety buses 15 and 16 consist of four relays arranged in one-out-of-two twice

coincident logic. These relays are set to actuate at 2625 ± 175 volts (63% of 4160 V) with no intentional time delay. The degraded grid voltage sensors on each of the 4.16 kV safety buses (15 and 16) consist of three relays arranged in two-out-of-three coincident logic. These relays are set to actuate at 3915 ± 18 volts with a time delay of 9 ± 1 seconds. The proposed voltage setpoints and associated time delays will ensure adequate voltages at the terminals of safety equipment and prevent spurious actuations of the degraded voltage protection, systems and are therefore acceptable.

The licensee also proposed to modify the existing diesel generator fast start logic to conform with the new degraded voltage protection logic. The proposed fast start logic will eliminate starts that are initiated by anticipatory transfer failure or source breaker lockout relay actuation but will retain automatic start on degraded voltage, loss of voltage or ECCS actuation. These diesel generator auto start signals are consistent with acceptable design practice on recently licensed plants and conform to our requirements. We find that the design is therefore acceptable.

Based on the information submitted we conclude that the offsite sources at the Monticello Nuclear Generating Plant when maintained within the operating voltage ranges established in conjunction with the onsite distribution system have the necessary capacity and capability to supply adequate voltages to ensure proper operation of Class 1E equipment in performing their safety functions under the worst case conditions analyzed and are therefore acceptable. The proposed design changes and Technical Specifications associated with the degraded grid voltage relays will ensure adequate protection of Class 1E equipment from sustained degraded voltage conditions and prevent unnecessary separation of safety equipment from the preferred offsite power source. We therefore find the proposed Technical Specification changes acceptable.

4.0 ENVIRONMENTAL CONSIDERATIONS

This amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

5.0 CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: J. Emami

Dated: November 27, 1984