

TECHNICAL EVALUATION OF THE
ELECTRICAL, INSTRUMENTATION, AND CONTROL DESIGN ASPECTS
OF
THE PROPOSED LICENSE AMENDMENT REVISION 1 FOR SINGLE-LOOP OPERATION
OF
THE MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1
(Docket No. 50-263)

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ABSTRACT

This report documents the technical evaluation of the proposed changes to the plant reactor protection system by the licensee of Monticello Nuclear Generating Plant, Unit 1, to account for single plant operation. This evaluation is restricted to only the electrical, instrumentation and control design aspects of proposed changes to the plant technical specifications for single-loop operation beyond 24 hours. The conclusion of the evaluation is that the Monticello Nuclear Generating Plant, Unit 1, license amendment for single-loop operation has met the review criteria provided anomalous control room indications are corrected or warning-tagged for the duration of single-loop operations.

FOREWORD

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I. INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated July 2, 1982 [Ref. 1], the Northern States Power Company submitted revised information to support its proposed license amendment to operate the Monticello Nuclear Generating Plant, Unit 1 with one recirculation loop out of service (i.e. single-loop operation). This revised submittal (i.e., Revision No. 1) supersedes their previous request which was dated September 7, 1976. This revised submittal includes information for the licensee's proposed revisions to Technical Specification Sections 2.1, 2.3 Bases, 3.2/4.2, 3.5/4.5, 3.5 Bases, 3.11, and 3.11/4.11 Bases, and an updated analysis report which presents a safety evaluation to justify single-loop operation. Conservative assumptions including uncertainties in the core total flow and TIP readings were evaluated and a review of accidents and abnormal operational transients associated with power operations in the single-loop mode were provided in NEDO 247271 [Ref 2] by General Electric Company, Nuclear Energy Division (GE-NED), the nuclear steam supply system designer for Monticello Nuclear Generating Plant. In response to an NRC request, the licensee provided supplemental information in a letter dated October 5, 1982 [Ref. 3], and in a conference call on September 26, 1983 [Ref. 4]. A letter to NRC documenting the conference call was dated September 29, 1983 [Ref. 5].

The purpose of this report is to document the evaluation of the electrical, instrumentation and control (EI&C) design aspects of the proposed license amendment change to the Monticello Unit 1 Technical Specifications. The consideration of proper plant variables, computer models, and the licensee's conclusions on core performance and clad temperature are outside the scope of this evaluation.

This review was conducted using 10CFR50, Appendix A, General Design Criteria 20 through 24 for Nuclear Power Plants [Ref. 6] and IEEE Standard 279-1971 [Ref. 7] with the following guidance from the staff for the application of Section 4.15, multiple setpoints, of the IEEE standard:

Manual switching to the more restrictive setpoint for the APRMs in the reactor protection system is acceptable for BWRs if sufficient administrative controls exist to assure that the more restrictive setpoints are in effect when required by the plant Technical Specifications.

The NRC has defined sufficient administrative controls as:

1. There is to be an independent check of the gain or setpoint adjustment.
2. The check is to be within the next shift.
3. Checks are by appropriate technical individuals (e.g., shift supervisor or S.R.O.).

The adjustments to the reactor protection system for single-loop operation (i.e., scram trip setpoint adjustments or APRM gain adjustments) must be within and therefore satisfy the functional requirements of the reactor protection system.

II. EVALUATION AND RECOMMENDATIONS

The current Monticello Unit 1 Technical Specifications do not permit single-loop plant operation at reduced power for more than 24 hours. The licensee's proposed Technical Specification changes would allow the reactor to operate at reduced power, not greater than 50% of rated thermal power, with one recirculation loop inoperable for more than 24 hours if certain changes are made to the reactor protection systems. Specifically, the changes are to the Average Power Range Monitor (APRM) scram trip setpoint and the Rod Block Monitor (RBM) rod block setpoint or to the APRM gain.

A different flow pattern is established in the vessel during single recirculation loop operation as compared to the normal two-loop operation [Ref. 2]. In single-loop operation, there is backflow through the jet pumps in the idle loop. The jet pump core flow measurement system is calibrated only when both loops are in operation and all jet pumps are in forward flow. The total core flow is the sum of the measured jet pump flows. In single-loop operation, the measured flow in the backflowing jet pumps must be subtracted from the flow through the other jet pumps. Also, the jet pump flow coefficient is different for reverse flow than for forward flow in the jet pumps.

Because of the different flow rate and flow path during single recirculation loop operation, the APRM SCRAM trip settings, which are flow-biased according to the equation in the proposed technical specifications, require resetting to protect the reactor from overpower. The rod block setpoint equation is flow-biased in the same way and with the same flow signal as the APRM setpoint, and must also be modified to provide adequate core protection for a postulated rod withdrawal error. This change is effectively accomplished by an APRM gain adjustment.

The manual APRM gain adjustment to accommodate single-loop operation is the only change imposed upon the Monticello Unit 1 reactor protection system (RPS). This modification adds the term 0.65 W to the APRM readings to compensate for backflow through the jet pumps in the idle loop. The licensee stated that sufficient range exists in the APRM gain settings to make the necessary adjustments to the reactor protection system for single-loop operation [Ref. 4]. This change will not cause the RPS to violate General Design Criteria 20 to 204 of 10CFR50 Appendix A.

The licensee provided in a letter dated September 29, 1983 [Ref. 5] the administrative controls to be used to assure that the gain adjustments are performed correctly. The Monticello staff will write a procedure which implements the requirements of the proposed single-loop operation. The multiple scram trip setpoints will not be used to adjust the reactor protection system for single-loop operation. Instead, the APRM scram and rod block settings will be effectively reset by the APRM gain adjustments. These gain adjustments for starting single-loop operation will be performed by the shift supervisor. The next shift supervisor (after single-loop operation has started) will independently review the settings as an administrative control. This meets the NRC definition for sufficient administrative controls.

III. CONCLUSIONS

Based on our review of the information and documents provided by the licensee in Refs. 1, 4 and 5, we conclude that the APRM gain adjustments for single-loop operation will satisfy the functional requirements of the reactor protection system.

The APRM gain adjustment to accommodate single-loop operation is the only change imposed upon the Monticello Nuclear Generating Plant reactor protection system (RPS) instrumentation. This change will not cause the RPS instrumentation system to violate 10CFR50 Appendix A General Design Criteria 20 through 24 [Ref. 6] or IEEE Standard 279-1971 [Ref. 7], with the exception of IEEE Standard as discussed below.

Because of backflow through the jet pumps during single-recirculation-loop operation, indications in the control room of individual jet pump flow and total summed core flow will be misleading. We recommend that those anomalous control room indications are corrected or warning-tagged for the duration of the single-recirculation-loop operation, as required by Section 4.20 of IEEE Standard 279-1971 [Ref. 7].

The administrative controls to be used by the licensee to assure the APRM gain adjustments are performed correctly meet the NRC criteria for sufficient administrative controls.

We recommend to NRC that upon implementation of the above recommended actions, the proposed electrical, instrumentation and control design aspects of the proposed license amendment for single-recirculation-loop operation at Monticello Nuclear Generating Plant Unit 1, is acceptable.

REFERENCES

1. NSPC Letter to NRC Director, Revision 1 to Licensee Amendment Request dated September 7, 1976, Single-Loop Operation, Monticello Nuclear Generating Plant, dated July 2, 1982.
2. General Electric Company, Nuclear Energy Division, Monticello Nuclear Generating Plant Single-Loop Operation, NEDO-24271, dated June 1980, (included as Exhibit C, with the "Revision 1 License Amendment Request dated Sept 7, 1976").
3. NSPC Letter (David Musolf) to NRC Director, Supplemental Information for Revision 1, dated October 5, 1982.
4. Telephone conference call NRC (Jack Donohew, Helen Nicolaras), NSPC (Bill Hill, Craig Nerom, Don Wagner); LLNL (Terry Donich) September 26, 1983.
5. NSPC letter (David Musolf) to NRR Director, Single-Loop Operation License Amendment Request Rev. 1, Additional Information, September 29, 1983.
6. Code of Federal Regulations, Title 10, Part 50. Appendix A: General Design Criteria for Nuclear Power Plants (Jan. 1982).
7. IEEE Standard 279-1971: Criteria for Protection Systems for Nuclear Power Generating Stations (n.d.).

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