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TECHNICAL EVALUATION OF THE
NOISE AND ISOLATION TESTING OF THE
REACTOR PROTECTION SYSTEM FOR THE
DAVIS BESSE NUCLEAR POWER STATION
UNIT 1

MASTER

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ABSTRACT

This report documents the technical evaluation of the noise and isolation testing of the reactor protection system (RPS) for the Davis Besse Nuclear Power Station, Unit 1. The testing was performed in accordance to Section 4.6.11, "Susceptibility," of MIL-N-19900B, and NRC approved plant test methods. Analysis of the test results shows that the reactor protection system did not degrade below acceptable levels when subjected to electromagnetic, electrostatic, isolation and noise level tests, nor was the system's ability to perform its Class 1E protective functions affected.

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FOREWORD

This report is supplied as part of the Selected Electrical, Instrumentation, and Control Systems Issues (SEICSI) Program being conducted for the U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Operating Reactors, by Lawrence Livermore National Laboratory, Engineering Research Division of the Electronics Engineering Department.

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UNIT 1

(Docket No. 50-346)

James C. Selan
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1. INTRODUCTION

In a letter dated January 11, 1979 [Ref. 1], the Toledo Edison Company submitted test results from noise and isolation testing of the Davis Besse Nuclear Power Station's reactor protection system (RPS). The tests were required by Amendment No. 7 to the License Condition 2.c.(3)(k) which the NRC issued November 9, 1977.

The purpose of the tests was to demonstrate that faults and interference noise on non-Class 1E circuits would not propagate to Class 1E circuits and degrade them below acceptable levels and to determine that selected system devices are immune to interference noise. The testing was to be done in accordance with Section 4.6.11, "Susceptibility," of MIL-N-19900B [Ref. 2] and plant test methods previously submitted and approved by the NRC.

The purpose of this report is to evaluate the licensee's submittal with respect to the NRC requirements.

2. EVALUATION

2.1 TEST DESCRIPTION

The reactor protection system (880NI/RPS, manufactured by Consumers Power Co.) was subjected to electromagnetic, electrostatic, and noise level tests. Also, system isolation tests were performed on selected devices of the RPS. A complete test description (test parameters, schematics, equipment list, procedures, and specifications) for each test was submitted by Toledo Edison Co. [Ref. 1]. Each test consisted of four basic parts: type of test, acceptance criteria, pretest values, and post-test values. After the system or device was subjected to a selected type of test, the test values were analyzed to determine if the system or device failed to meet the acceptance criteria.

2.2 ANALYSIS

This section presents a synopsis of the tests conducted and the results of the tests.

2.2.1 Isolation Capability Tests

One bistable module and one fan failure detector were subjected to the isolation test to demonstrate the electrical isolation capability of the digital isolation devices used in the reactor protection system.

The licensee states, and my analysis confirms, that both devices tested either met or exceeded the acceptance criteria with the exception of the insulation resistance test. The resistance values obtained were influenced

by a noise level in the measurement process. However, the absolute value of the insulation resistance readings were at least two orders of magnitude above the manufacturer's specifications, and this is determined to be acceptable.

2.2.2 Module Basis Electromagnetic Interference (EMI) Susceptibility Tests

One contact-monitoring channel and one analog pressure channel were subjected to the EMI test to demonstrate the capability of the reactor protection system to perform Class 1E protective functions in the presence of electromagnetic and electrostatic interferences.

The licensee states, and my analysis confirms, that both devices tested met all of the acceptance criteria.

2.2.3 Electrostatic Fault Tests

The reactor protection system was subjected to electrostatic fault tests to demonstrate its capability to perform Class 1E protective functions in the presence of transient signals. These signals are capacitively coupled from fault voltages appearing on non-Class 1E signal output leads.

The licensee states, and my analysis confirms, that the system tested met all of the acceptance criteria.

2.2.4 Electromagnetic Fault Tests

The reactor protection system was subjected to electromagnetic fault tests to demonstrate its capability to perform Class 1E protective functions in the presence of electromagnetic interference signals. These signals are generated by fault currents flowing in non-Class 1E signal output leads.

The tests performed were in accordance with Section 4.6.11 of MIL-N-19900B.

The licensee states, and my analysis confirms, that the system tested met all of the acceptance criteria.

2.2.5 Electromagnetic Interference
 (EMI) Susceptibility Tests

The reactor protection system was tested to demonstrate the system's capability to perform its protective functions in the presence of electromagnetic and electrostatic interference signals that may appear on the non-Class 1E output signal cables outside the protection system cabinets.

A component failure during post-test recalibration should be noted. One buffer amplifier could not be zeroed (exhibited a drift) in the checkout procedure. The component failure, as stated by the licensee, was random in nature and was not directly or indirectly induced by the testing procedure.

The licensee states that the component failure (drift) did not contribute an error of enough significance to invalidate the test results. My analysis of the test results confirms the system tested met all of the acceptance criteria.

3. CONCLUSION

Based on the information provided by the Toledo Edison Company for the Davis Besse Nuclear Power Station, Unit 1, the reactor protection system has adequately demonstrated its capability to perform the Class 1E protective functions when subjected to electrostatic, electromagnetic, isolation and noise level tests. The above tests were performed to NRC approved test methods and MIL-N-19900B as required.

Accordingly, I recommend that the NRC approve the isolation and noise testing of the reactor protection system to meet License Condition 2.c.(3)(k).

REFERENCES

1. Toledo Edison Company letter and attachments to NRC (R. N. Reid), dated January 11, 1979.
2. Military Specification, Nuclear Propulsion Control and Instrumentation of Equipment, General Requirements (MIL-N-19900B), Section 4.6.11, "Susceptibility."