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TECHNICAL EVALUATION OF THE PROPOSED DELETION OF A
REACTOR TRIP ON A TURBINE TRIP BELOW 50-PERCENT POWER
FOR THE BEAVER VALLEY NUCLEAR POWER PLANT, UNIT 1

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ABSTRACT

This report documents the technical evaluation of the Duquesne Light Company's proposed license amendment for the deletion of a reactor trip on a turbine trip below 50-percent power for the Beaver Valley nuclear power plant, Unit 1. This report is supplied as part of the Selected Electrical, Instrumentation, and Control Systems Issues Program being conducted for the U. S. Nuclear Regulatory Commission by Lawrence Livermore Laboratory.

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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 Laboratory, Field Test Systems Division of the Electronics Engineering Department.

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1. INTRODUCTION

In a letter¹ dated October 27, 1978, the Duquesne Light Company, the holder of license #35, submitted a license amendment request to the U. S. Nuclear Regulatory Commission (NRC) for the deletion of a reactor trip on a turbine trip below 50-percent power for the Beaver Valley nuclear power plant, Unit 1. The licensee's present criteria state that they will trip the reactor any time the power turbine trips when the plant is operating above 10 percent of rated power.

The purpose of this report is to review and evaluate the technical aspects of the licensee's submittal² and to determine if it meets the criteria established by the NRC.

2. EVALUATION OF THE BEAVER VALLEY NUCLEAR POWER PLANT, UNIT 1

2.1 INTRODUCTION

Presently, the Beaver Valley nuclear power plant, Unit 1, reactor protection system (RPS) provides for a reactor trip upon a turbine trip when the plant is operating above 10 percent power. Since both the reactor and the turbine will accept a 50-percent load rejection, a reactor trip is not necessary because of a turbine trip below 50-percent power. The licensee's pending design change will initiate a reactor trip upon a turbine trip at or above 50-percent power.

Two-out-of-four channel logic will be used to detect 50-percent power and yield permissive P-9. This permissive will be developed in the RPS logic racks and will be wired into the reactor trip matrices. The P-9 permissive logic will be testable, using the same design techniques as for other protection logic relays. An associated logic change will modify the steam dump logic.

2.2 LICENSEE'S PROPOSED CHANGES

Pursuant to the Code of Federal Regulations, Title 10, Part 50.59 (10 CFR 50.59),³ the licensee proposes the following changes to Appendix A of its technical specifications:

- (1) Add Section 7, 3.3-1, which reads

"P-9 - With 2 of 4 power range neutron flux channels >51% of rated thermal power, P-9 prevents or defeats the automatic blocks of reactor trip on turbine trip."

- (2) Add limiting safety settings B2-7, which read

"Turbine Trip - A turbine trip causes a direct reactor trip when operating above P-9. Each of the turbine trips provides turbine protection and reduces the severity of the ensuing transient. Their functional capability at the specified trip settings is required to enhance the overall reliability of the reactor protection system."

2.3 REVIEW OF THE LICENSEE'S SUBMITTAL

A review was made of the licensee's submittal, and the following technical aspects were presented:

- (1) The proposed P-9 interlock will block a reactor trip due to a turbine trip when the unit is below the setpoint. The block action occurs when three-out-of-four neutron-flux, power-range signals are below the setpoint. Below P-9, therefore, the reactor will be allowed to operate and the turbine trip transient will ride out as a load rejection with reactor power dissipated by a steam dump. When two-out-of-four signals measure above the P-9 setpoint, the reactor will be tripped.
- (2) The low feedwater flow trip is actuated by a steam/feedwater flow mismatch (i.e., one-out-of-two logic). No interlocks are associated with this trip.
- (3) The low-low steam-generator water-level trip (i.e., two-out-of-three logic) will initiate a low feedwater flow reactor trip.
- (4) The turbine trip-reactor trip is actuated by two-out-of-three logic from low autostop oil pressure signals or by all closed signals from the turbine steam stop valves. A turbine trip, therefore, causes a direct reactor trip above P-9 (i.e., at 50-percent thermal power).
- (5) A reactor trip occurs when the emergency core cooling system (ECCS) is actuated.
- (6) The manual trip has no interlocks to block the reactor trip operation.

- (7) The power-range, high-flux reactor trip provides safety from reactivity excursions during start-up.
- (8) The high and low pressure trips limit the pressure operating range of the system.
- (9) The overtemperature delta t reactor trip provides for core protection against a departure from nucleate boiling (DNB) for a combination of pressure, power, coolant, temperature, and power distribution excursions.
- (10) The system is designed with a steam dump function which is capable of bypassing up to 50 percent of the rated load steam.
- (11) The Final Safety Analysis Report (FSAR)² for the Beaver Valley nuclear power plant, Unit 1, does not take the steam dump system into account.

3. CONCLUSIONS

The technical aspects of the Duquesne Light Company's submittal for the Beaver Valley nuclear power plant, Unit 1, license amendment were reviewed. Based on this review, we conclude the following:

- (1) No degradation of the engineered safety features occurs due to this proposed change.
- (2) The system has the capability to bypass 50 percent of rated power steam around the turbine.
- (3) No credit is taken for the steam dump system in the Final Safety Analysis Report (FSAR).²

We recommend that the NRC approve this proposed change for the deletion of a reactor trip on a turbine trip below 50-percent power.

REFERENCES

1. Duquesne Light Company letter (C. Dunn) to NRC/DOR (A. Schwencer), dated October 27, 1978.
2. Duquesne Light Company submittal for license amendment:
 - (a) Beaver Valley nuclear power plant, Unit 1, Final Safety Analysis Report (FSAR) amended draft, dated July 27, 1978.
 - (b) Deletion of reactor trip on turbine trip below 50-percent power analysis, by G. Narasimhan.
 - (c) Changes to the technical specifications, Section 7, and precautions, limitation and setpoints document, Section 8.
3. Code of Federal Regulations, Title 10, Part 50.59 (10 CFR 50.59).

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