



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE TURBINE MAINTENANCE PROGRAM

HOUSTON LIGHTING & POWER COMPANY

DOCKET NOS. 50-498 AND 50-499

SOUTH TEXAS PROJECT, UNITS 1 AND 2

INTRODUCTION

In Section 3.5.1.3 of the Safety Evaluation Report related to the operation of South Texas Project, Units 1 and 2 (NUREG-0781), the staff concluded that the probability of unacceptable damage to safety-related systems and components by turbine missile generation is acceptably low provided the turbine missile generation probability is maintained at  $1.0E-4$  or less by an acceptable maintenance program. In a letter dated October 31, 1985, the licensee committed to submit for NRC approval, within three years of obtaining an operating license, a turbine system maintenance program based on the manufacturer's calculations of missile generation probabilities.

By letter dated August 28, 1990 and supplemented on December 26, 1990, the licensee submitted its Turbine System Maintenance Program for staff review.

BACKGROUND

General Design Criterion 4, "Environmental and Missile Design Bases," of Appendix A to 10 CFR Part 50 requires that structures, systems, and components important to safety are protected against the effects of missiles that might result from such failures.

In the past, the staff evaluation of the effects of turbine missiles on the public health and safety followed Regulatory Guide (RG) 1.115, "Protection Against Low-Trajectory Turbine Missiles," and Standard Review Plan (SRP), 10.2, 10.2.3, and 3.5.1.3. According to SRP 2.2.3 and RG 1.115, the probability of unacceptable damage from turbine missiles, P4, should be less than or equal to  $1.0E-6$  per year for an individual plant. This probability is the product of (1) the probability of turbine failure resulting in the ejection of turbine disc fragments through the turbine casing, P1; (2) the probability of ejected missiles perforating intervening barriers and striking safety-related structures, systems, or components, P2; and (3) the probability of struck structures, systems, or components failing to perform their safety function, P3.

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In recent years, the staff has shifted review emphasis and regulatory requirements from P2 and P3 to P1. Licensees are required to show that the turbine missile generation probability, P1, satisfies turbine reliability requirements criteria. For a favorably oriented turbine, such as the South Texas turbines P1 should be less than  $1.0E-4$  per year. This is the general, minimum reliability requirement for loading the turbine and bringing it on line. If P1 falls between  $1.0E-4$  per year and  $1.0E-3$  per year, the turbine may be kept in service until the next scheduled outage, at which time the licensee is to take action to reduce the probability to meet the  $1.0E-4$  per year limit before returning the turbine to service.

In order to assure that the licensee's turbine missile probabilities satisfy the staff's turbine reliability requirement, the staff requires licensees to submit, within 3 years of operation, a turbine maintenance program that includes maintenance activities and inspection intervals, which are based on the manufacturer's calculations of turbine missile generation probabilities.

#### EVALUATION

Each main turbine at South Texas was manufactured by Westinghouse and consists of a high pressure turbine and three low pressure turbines, LP1, LP2, and LP3. The licensee's schedule calls for inspection of the Unit 1 turbines after 15660 hours, 20670 hours, and 35350 hours of operation for turbines LP1, LP2, and LP3, respectively. For Unit 2, the inspection schedule is 32660 hours, 34810 hours, and 34340 hours for turbines LP1, LP2, and LP3, respectively. The intervals were calculated based on the Westinghouse method. The probability calculation showed that with the above inspection schedule, the probability of missile generation for each low pressure turbine will be less than or equal to  $3.33E-5$  per year. This satisfies  $1.0E-4$  per year specified in SER Section 3.5.1.3. The licensee's turbine maintenance program also requires that the turbine rotor assembly be subjected to a full non-destructive examination according to the above schedule.

Maintenance of the turbine overspeed protection system is also a major part of the overall program. In accordance with the plant technical specification 3/4.3.4.2, the licensee tests the turbine valves (stop, governor, reheat stop and intercept valves) once per 31 days in Modes 1 and 2 to verify operability. One of each type of these valves is disassembled and inspected at least once per 40 months. The licensee also does surface and visual inspection on valve seats, discs and stems. If unacceptable flaws or excessive corrosion are found, all other valves of that type will be inspected. The electrical overspeed protection device is calibrated at least once every eighteen months and the mechanical overspeed trip is tested following each major turbine outage.

#### CONCLUSION

The staff concludes that the turbine maintenance program at South Texas Units 1 and 2 is acceptable because the licensee's turbine missile generation probability satisfies the staff's requirement of  $1.0E-4$  per year.

The maintenance program of the turbine overspeed protection system satisfies the surveillance requirements as specified in Technical Specification 3/4.3.4.2.

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Principal Contributor: J. Tsao, NRR