June 24, 1982

Docket No. 50-206
LS05-82-06-090

Mr. R. Dietch, Vice President
Nuclear Engineering and Operations
Southern California Edison Company
2244 Walnut Grove Avenue
Post Office Box 800
Rosemead, California 91770

Dear Mr. Dietch:

SUBJECT: SYSTEMATIC EVALUATION PROGRAM TOPIC III-4.B, TURBINE MISSILES
SAN ONOFRE UNIT 1

Enclosed is a copy of our draft evaluation of Systematic Evaluation Program Topic III-4.B for the San Onofre Unit No. 1 Nuclear Generating Station.

You are requested to examine the facts upon which the staff has based its evaluation and respond either by confirming that the facts are correct, or by identifying errors and supplying the corrected information. We encourage you to supply any other material that might affect the staff's evaluation of this topic or be significant in the integrated assessment of your facility.

Your response is requested within 30 days of receipt of this letter. If no response is received within that time, we will assume that you have no comments or corrections and will consider the topic complete.

Sincerely,

Walt Paulson,,Project Manager
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

SEO4
DSU USE (08)

*See previous yellow for additional concurrences.

OFFICE	SEPB:DL	SEPB:DL	SEPB:DL	ORB#5:PM	ORB#5:BC	AD:SA:DL	
SURNAME	EMcKenna:dk*	CGrimes*	WRussell	WPaulson	DCrutchfield	GLainas	
DATE	6/22/82	6/22/82	6/23/82	6/24/82	6/23/82	6/24/82	

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You are requested to examine the facts upon which the staff has based its evaluation and respond either by confirming that the facts are correct, or by identifying errors and supplying the corrected information. We encourage you to supply any other material that might affect the staff's evaluation of this topic or be significant in the integrated assessment of your facility.

Your response is requested as soon as possible. If no response is received by the time the next phase of the integrated assessment of your facility begins, we will assume that you have no comments or corrections and will consider the topic complete.

Sincerely,

Walt Paulson, Project Manager
Operating Reactors Branch No. 5
Division of Licensing

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NRC FORM 318 (10-80) NRCM 0240 OFFICIAL RECORD COPY USGPO: 1981—335-960

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SYSTEMATIC EVALUATION PROGRAM
TOPIC III-4.B

SAN ONOFRE

TOPIC III-4.B, TURBINE MISSILES

I. INTRODUCTION

The purpose of this topic is to assure that, with respect to potential turbine missiles, all structures, systems and components important to safety either have adequate protection by means of structural barriers or have an acceptably low probability of damage.

II. REVIEW CRITERIA

10 CFR 50, Appendix A, GDC 4.

III. RELATED SAFETY TOPICS AND INTERFACES

III-4.C Internally Generated Missiles.

IV. REVIEW GUIDELINES

Standard Review Plan (SRP) Section 3.5.1.3, Regulatory Guides (R. G.) 1.115 and 1.117.

V. EVALUATION

During November 1979, the NRC staff became aware of low pressure turbine disc cracking in Westinghouse turbines at several operating plants. Additional inspections at other plants possessing Westinghouse turbines also indicated cracking thus implying a generic problem applicable to plants with Westinghouse turbines. Consequently, on February 25, 1980, the NRC issued 50.54(f) letters to utilities with Westinghouse low pressure turbines requesting information related to this problem. Both Westinghouse and the NRC staff have been following this problem closely and have developed independent crack growth models.

The findings of multi-plant action, B-46, "Turbine Missiles," concluded that an inspection schedule based on an approach developed by Westinghouse for their turbines provides an acceptably high degree of assurance that discs will be inspected before cracks can grow to one-half of a size that could cause disc failure at speeds up to design speed.

Southern California Edison (SCE) was provided with a safety evaluation report of this approach and was requested to commit to use the four criteria listed on page 3 of the safety evaluation report (Reference 1). SCE responded to this request (Reference 2) and committed to the use of the four criteria. As a result of this commitment, an acceptably high degree of assurance is provided that disc failures at design speed will not occur.

As a result of the turbine cracking problem, Westinghouse has revised its probability analysis of damage to safety related structures, systems and components. The analysis includes utilizing the following individual probabilities: (1) the probablity of turbine failure leading to the ejection of turbine missiles due to design speed failures and destructive overspeed failures (P1), (2) the probability of strike (P2) and (3) the probability of damage (P3). Since the evaluation of the latest Westinghouse probability analyses has not been completed by the staff, criteria, considering turbine cracking and the implemented inservice inspection program, have not been established for determining what actions, if any, are required.

Two independent turbine overspeed trip devices are installed on the turbine generator.

1. A standard mechanical overspeed trip, consisting of an offset trip weight held by a compression spring, is intalled on the turbine. Centrifugal force acting on the shaft mounted trip weight is opposed by the compression spring. At high shaft speed, the centrifugal force becomes large enough to overcome the spring force and the trip weight moves out, activating a mechanical linkage that dumps auto stop oil and trips the unit.

2. A backup overspeed trip device is also installed that senses generator output frequency. At a preselected value, this device initiates a turbine trip by energizing the solenoid trip device. The solenoid trip is an electrical device that acts on an operating plate lever causing the turbine to be shutdown when the solenoid is actuated. The generator and 18 kV electrical system are also isolated at the same time the turbine is tripped by the backup overspeed device. The solenoid trip is also energized by a load drop anticipator unit. This device compares unit electrical load and low pressure turbine steam flow. It energizes the solenoid trip when low pressure turbine steam flow is in excess of 50 percent of the full load value in coincidence with a unit electrical load of 20 percent or less.

   When the turbine is tripped, control oil, as well as auto stop oil, is dumped by activation of six solenoid valves installed on the control oil system. These valves were not part of the original turbine control and protection system and provide an additional degree of redundancy for turbine protection.

The initial design overspeed for the San Onofre 1 turbine-generator was 127% of nominal rotating speed. Since the turbine-generator does not have reheat intercept or stop valves, this design speed is higher than for other Westinghouse units.

Following two incidents of turbine overspeed in 1971, the design basis for the turbine overspeed was changed. The unit operates at full capacity with specific limits on reheater tube leakage, condenser back pressure and overspeed trip setpoints to limit overspeed to 133% of nominal assuming failure of the turbine control system and turbine trip due to operation of the mechanical overspeed trip device.

In Reference 3, the licensee performed a comparison of the turbine overspeed protection system with the requirements of IEEE-279 (1971). The conclusions were that they system satisfied the redundancy, independence, separation and single failure provisions.

A testing program is performed for the overspeed protection system. The following tests are done yearly when the turbine is off line:

1. Overspeed governor oil trip
2. Governor and auxiliary governor tests
3. Backup overspeed trip device
4. Mechanical overspeed
5. Solenoid trip test
6. Control valve leakage
7. No load trip test

The extraction steam BTV is tested each shift. The overspeed governor oil trip is tested monthly.

Every two week, while the plant is operating, power is reduced and each control and stop valve combination is exercised.

VI. CONCLUSION

The inspection program committed to by Southern California Edison (References 1 and 2) provides an acceptably high degree of assurance that turbine discs will not fail at speeds up to design speed. The testing program of the overspeed protection system, including the stop and control valves at San Onofre 1, provides reasonable assurance that the overspeed protection system will remain operable and, thereby, limit the likelihood that overspeed past the design conditions would occur.

The staff concludes, for an interim period until a decision is reached regarding the need for updated probabilistic analysis of the turbine missile hazard, the probability of damage from turbine missiles is acceptably low. Should further reviews of operating plants and/or additional requirments be deemed necessary, the San Onofre 1 plant will be included with that operating plant action.

REFERENCES

1. Letter from D. Crutchfield (NRC) to R. Dietch (SCE), dated December 10, 1981.

2. Letter from K. Baskin (SCE) to D. Crutchfield (NRC), dated March 24, 1982.

3. San Onofre Nuclear Generating Station Unit No. 1, Final Safety Analysis, Part II, Volume VI, Supplementary Information, Item 4.2 of Responses to Specific Items of Interest.