Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

November 14, 2002
NOC-AE-02001335
10CFR50.90
STI: 31452163

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

South Texas Project
Units 1 & 2
Docket Nos. 50-498, 50-499
Proposed License Amendment
to Eliminate the Turbine Missile Design Basis

STP Nuclear Operating Company (STPNOC) proposes to amend the operating licenses for South Texas Project Units 1 and 2 to delete the UFSAR turbine missile design basis. STPNOC has determined that the turbine missile contribution to risk is so small that no special measures are required beyond normal commercial operating practices.

STPNOC determined the proposed change requires prior NRC approval as a departure from a methodology as described in 10CFR50.59(c)(1)(viii). The safety evaluation, environmental evaluation, and determination of no significant hazards are attached.

The STP Plant Operations Review Committee has reviewed the proposed amendment and recommended it for approval. The STP Nuclear Safety Review Board has approved the proposed amendment.

STP Nuclear Operating Company requests 30 days for implementation of the amendment after approval.

A053

If there are any questions, please contact Mr. A. W. Harrison at 361-972-7298 or me at 361-972-8757.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 11/14/02

J. J. Sheppard
Vice President and
Assistant to the President and CEO

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Attachment: Description of Changes and Safety Evaluation

cc:
(paper copy)

Ellis W. Merschoff
Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, Texas 76011-8064

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Richard A. Ratliff
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3189

Cornelius F. O'Keefe
U. S. Nuclear Regulatory Commission
P. O. Box 289, Mail Code: MN116
Wadsworth, TX 77483

C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

(electronic copy)

A. H. Gutterman, Esquire
Morgan, Lewis & Bockius LLP

M. T. Hardt/W. C. Gunst
City Public Service

Mohan C. Thadani
U. S. Nuclear Regulatory Commission

R. L. Balcom
Reliant Energy, Inc.

A. Ramirez
City of Austin

C. A. Johnson
AEP - Central Power and Light Company

Jon C. Wood
Matthews & Branscomb

Description of Changes and Safety Evaluation

1. Description

STPNOC proposes to eliminate the turbine missile design basis from the STP Unit 1 and Unit 2 UFSAR. STPNOC's analyses have determined that turbine missiles pose no credible threat to the nuclear safety design of the STP units and warrant no special regulatory consideration at STP. As described in Section 2, the change involves eliminating the design basis description from the STP UFSAR and removing the Turbine Overspeed operating specification from the STP Technical Requirements Manual. No Technical Specifications are affected by the proposed change.

2. Proposed Change

Section 3.5.1.3 of the STP UFSAR describes the station design basis for turbine missiles. Technical Requirements Manual (TRM) Specification 3/4.3.3.4 contains the operational requirements for turbine overspeed components credited for the prevention/mitigation of turbine overspeed events that could contribute to the generation of a turbine missile.

STPNOC proposes in this change to eliminate the UFSAR Section 3.5.1.3 design basis description and to delete the TRM requirements. Markups of the proposed changes are attached for the staff's information.

There are no changes required for the Technical Specifications.

3. Background

Section 3.5.1.3.5 of the UFSAR states:

> The results of the turbine missile analysis have demonstrated that the probability of damage to safety-related components is less than 10^{-7} per year, which satisfies regulatory requirements. This probability is maintained below this value by maintaining the probability of turbine missile generation below 10^{-4} per year, which is accomplished by the South Texas Turbine System Maintenance Program described in section 3.5.1.3.4.

STPNOC analyses have determined that there is no need to credit the Turbine System Maintenance Program to maintain an acceptably low probability of damage to safety related components.

Although no change to the STP Technical Specifications is required, STPNOC determined the proposed change requires prior NRC approval as a departure from a methodology as described in 10CFR50.59(c)(1)(viii). Section 3.2 of NEI 96-07, "Guidelines for 10CFR50.59 Implementation", specifically names turbine missiles as "an accident previously evaluated in the FSAR (as updated)". The evaluation methodology is specifically described in the UFSAR; consequently, changes to the described methodology (e.g., deletion) requires prior NRC approval.

4. Technical Analysis

The orientation of the turbine relative to Safety Related Systems, Components, and Structures is shown in STP UFSAR Fig. 3.5-1 (attached). The only safety-related systems, structures or components located within the ± 5° strike zone are the ECW buried piping and a small portion of the Unit 1 Diesel Generator Building (DGB). The ECW piping is buried to a sufficient depth to prevent damage from a direct strike. The probability of striking the Unit 1 DGB with a missile ejected from the Unit 2 turbine is very small. This very favorable orientation of the STP turbines justifies elimination of the turbine missile generation from the safety analysis. The probabilistic assessment described below shows that the likelihood of core damage, given a turbine missile is generated, is insignificant.

A probabilistic risk assessment study was performed to evaluate the probability of core damage given that the main turbine of either Unit generates a missile. It does not involve a significant increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety. The probability of core damage, given that a turbine missile is generated, is 3.74E-08 for shear failure and 3.09E-08 for shear and rotational failure.

Assuming the likelihood of a turbine missile is less than 1.0E-04/yr, the core damage frequency (CDF) is less than 1.0E-11/yr. The result is significantly below the acceptable levels for core damage frequency change justified by Regulatory Guide 1.174. As shown above, the acceptability of the result does not depend on maintaining the turbine missile generation frequency below 1.0E-04/yr.

From this evaluation, it can be concluded that testing of the turbine governor and intercept valves generates unnecessary exposure to a turbine trip without commensurate benefit to nuclear safety.

The proposed change meets the other criteria of RG 1.174:

1. The change is consistent with current regulations. Approval of the proposed change does not involve an exemption to any regulation.

2. The change is consistent with the defense-in-depth philosophy. STP is not proposing to change the design basis of the plant or how the plant responds to transients or accidents.

3. The change retains sufficient safety margins. The PRA was performed with conservative assumptions with regard to the consequences of turbine missile impact on safety related structures. STP does not expect the reliability of the turbine systems to be significantly affected by the proposed change. Because of the critical nature of the turbine and associated systems to overall plant performance and reliability, STP will have an effective maintenance and monitoring program for the turbine for commercial reasons. Because of the very low safety significance associated with turbine missile generation, no additional monitoring is warranted.

4. As discussed above, the changes in risk are not significant and are offset by the reduction in the potential for plant trip from reduced testing of the turbine governor and intercept valves.

5. Regulatory Safety Analysis

5.1. No Significant Hazards Consideration

STPNOC has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10CFR50.92, "Issuance of amendment," as discussed below.

1) Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The turbine missile generation probability will not be significantly increased by elimination of the regulatory commitments in the UFSAR. No plant changes are proposed that would significantly increase the probability of turbine missile generation. Turbine missile generation does not pose a credible threat to safety related components and consequently has no potential to increase radiological consequences.

2) Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed changes involve no physical modification of the plant or different operating configurations.

3) Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

Turbine missiles do not constitute a credible threat to nuclear safety at STP. They are not a consideration in any plant safety analysis. Changing the regulatory commitment with regard to design for turbine missiles has no effect on any margin of safety.

Conclusion

Based upon the analysis provided herein, the proposed amendments do not involve a significant hazards consideration.

5.2. Applicable Regulatory Requirements

STP's UFSAR states that STP meets the intent of Regulatory Guide 1.115 Rev. 1 "Protection Against Low-Trajectory Turbine Missiles". The Regulatory Guide supports compliance with General Design Criterion 4, "Environmental and Missile Design Bases," of Appendix A to 10 CFR Part 50, which requires, in part, that structures, systems, and components important to safety be appropriately protected against the effects of missiles that might result from equipment failures.

As described in the Technical Analysis, STPNOC has determined that turbine missiles do not pose a credible threat to safety related components at STP. Consequently, there is no adverse effect of the proposed change on the regulatory design basis of the plant.

6. Environmental Consideration

10 CFR 51.22(b) specifies the criteria for categorical exclusion from the requirements for a specific environmental assessment per 10 CFR 51.21. This amendment request meets the criteria specified in 10 CFR 51.22(c)(9). The specific criteria contained in this section are discussed below.

(i) the amendment involves no significant hazards consideration

As demonstrated in the No Significant Hazards Consideration Determination, the requested license amendment does not involve any significant hazards consideration.

(ii) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite

The requested license amendment involves no change to the facility and does not involve any change in the manner of operation of any plant systems involving the generation, collection or processing of radioactive materials or other types of effluents. Therefore, no increase in the amounts of effluents or new types of effluents would be created.

(iii) there is no significant increase in individual or cumulative occupational radiation exposure

The requested license amendment involves no change to the facility and will not increase the radiation dose resulting from the operation of any plant system. Furthermore, implementation of this proposed change will not involve work activities that could contribute to occupational radiation exposure. Therefore, there will be no increase in individual or cumulative occupational radiation exposure associated with this proposed change.

Based on the above it is concluded that the change meets the criteria specified in 10 CFR 51.22 for a categorical exclusion from the requirements of 10 CFR 51.21 relative to specific environmental assessment by the Commission.

7. Licensing Document Changes

UFSAR Changes:

Table 3.12-1, "Regulatory Guide Matrix": Change listing for RG 1.115 from "B" - meets the intent to "G" - no commitment to this guide.

Section 3.5.13

[Note to reviewer: The figures associated with these UFSAR sections will also be deleted.]

Turbine missiles have been evaluated not to be a credible threat for the STP design basis.

~~3.5.1.3.1 Introduction: The potential for damage to safety-related targets which include safety-related structures, systems and components due to turbine failure was evaluated prior to receiving the operating licensing to determine whether additional protection, beyond that inherently provided by plant building orientation and existing structural shielding, need be provided to further reduce the probability of damage. The total probability of damage was calculated for each seismic Category I target by evaluating the product of the probability for missile generation, the probability of striking the target, and the probability of the barrier failing to protect the target.~~

~~The result of this evaluation was that the turbine missile generation probability (P1) is less than 10^{-4} per year and the combined probability of the missile striking a target and the barrier failing to protect the target is less than 10^{-3}. Therefore, the total probability of damage to safety-related components is less than 10^{-7} per year.~~

~~Because plant construction will be relatively unaffected over the life of the plant, the combined probability of striking a target and the barrier failing to protect a target will not change from this initial value of 10^{-3} per year. Therefore, South Texas has focused on maintaining P1 below 10^{-4} per year to assure that the total probability of damage to safety-related components remains less than 10^{-7} per year. P1 is maintained below 10^{-4} per year by the South Texas Turbine System Maintenance Program, which is described in further detail in section 3.5.1.3.4.~~

~~3.5.1.3.2 System Description: Each STP turbine-generator includes one high-pressure turbine rotor and 3 low-pressure turbine rotors. The High Pressure turbine rotor is of integral forged construction and is not subject to failure due to stress corrosion cracking or destructive overspeed. (Ref. 3.5-2)~~

~~The low-pressure rotors utilize discs installed with a shrink fit to the shaft. The discs are keyed to the shaft to prevent torsional slippage under unusual conditions of overspeed and/or transient temperature conditions. Each low-pressure rotor includes 12 shrunk-on discs.~~

~~Three different styles of disc are used on rotors either in use or planned for use at this station. The rotors supplied as original equipment utilized "light discs". A later model rotor utilizes "medium discs" for 6 of the 12 discs. The latest model of these rotors utilizes "heavy discs" for 6 of the 12 discs. Rotors utilizing these 3 styles of discs are interchangeable in the Low Pressure turbines of each unit.~~

~~The light discs are keyed to the shaft with 3 round keys installed in the downstream side of the disc bore. Discs of this design have proven susceptible to stress corrosion cracking, with cracks originating in the keyway or (much less frequently) at the ID of the disc bore. The record of inspections of these discs comprise a large data base maintained by Westinghouse, which provides a good statistical basis for Westinghouse predictions of crack initiation and crack propagation rate probabilities.~~

~~The medium disc style utilizes a completely different method of keying the disc to the shaft. In this style, the keyway is not located in the highly stressed shrunk on disc bore. The part keyed to the shaft is called a "key plate". This key plate is bolted to the disc at the lower stressed point on the disc. The base of this style disc is also slightly beefier, hence the term medium disc. These discs are made of steel with improved fracture toughness and lower yield strength for improved resistance to disc rupture and crack initiation.~~

~~The heavy disc style is similar to the medium disc style, with further improvements in metallurgy, detailed improvements in disc profile, and improvements in blade and steam path design not related to the probability of missile generation.~~

~~The last 3 discs on each end of each rotor are of the light disc style, regardless of the rotor model. The temperature at the keyway of these discs is below 200°F. No stress corrosion cracks have been found on discs which operate at this temperature or below. In addition, because the rate of propagation of a stress corrosion crack is highly temperature dependent, the rate of propagation of a crack initiated in one of these discs would be much lower than in one of the discs 1, 2, or 3. (Ref. 3.5-35)~~

~~3.5.1.3.3 Turbine Missile Generation: The probability of missile generation from each disc of each rotor is provided by Westinghouse. The data covers periods of operation of 1, 2, 3, 4, 5, and 10 years. The analysis uses metallurgical properties from test coupons taken during fabrication of each disc and calculated values of localized conditions at normal operation (stresses and temperatures at the keyway and/or disc bore, etc.), combined with statistical probabilities of crack initiation, to calculate the probability of disc rupture due to stress corrosion cracking at rated speed and design overspeed. The design overspeed analysis also factors in the probability of a design overspeed event. The probability of disc rupture is combined with the probability of disc fragments penetrating the turbine casing to determine the probability of missile generation for each disc. The probability of missile generation for each rotor is the sum of the probabilities of the installed disc. (Ref. 3.5-34)~~

~~The Westinghouse data is used to determine the "probabilistic interval" for each rotor. This interval is selected to keep the total for 3 rotors below 1×10^{-4} missiles per unit per year either by keeping the total for each rotor at or below one-third that value, or by a more detailed calculation using the installed configuration and conservative rotor operating intervals. The probabilistic interval for individual rotors is set at 60 months if the calculation provides a longer interval. Start-up of the turbine following a scheduled outage (refueling outage or planned outage of sufficient duration to inspect an L.P. rotor) is allowed if and only if the actual operating time of the installed rotors is less than their probabilistic interval. Some additional analysis of the Westinghouse data is necessary to interpolate between data points and to obtain a probability density function (missiles per year) from the overall probabilities given in missiles over the stated operating period.~~

~~If the actual operating time exceeds the probabilistic interval of one or more of the installed rotors between scheduled outages, the turbine is allowed to operate until the next scheduled outage, provided the overall probability of missile generation remains below 1×10^{-3} missiles per year per unit. Data from rotors current on site show if P1 is less than 1×10^{-4} at the beginning of an operating cycle, P1 will be less than 1×10^{-3} with 18 months more operating time.~~

~~The orientation of the turbine relative to Safety Related Systems, Components, and Structures is shown in Fig. 3.5-1. The strike zone of the number 1 through number 5 discs is ± 5° from the rotational plane. The only safety related systems, structures or components located within the ± 5° strike zone are the ECW buried piping and a small portion of the Unit 1 Diesel Generator Building. The ECW piping is buried to a sufficient depth to prevent damage from a direct strike. The probability of striking the Unit 1 DGB with a missile ejected from the Unit 2 turbine is very small.~~

~~The strike zone of the number 6 discs is + 5° to + 25° from the rotational plane. Safety related systems, components, and structures are located in the potential strike zone of some of the number 6 discs on Unit 1 and all of the number 6 discs on Unit 2. Because the number 6 discs have the lowest operating stress and lowest operating temperature, these discs have a much lower probability of disc rupture due to stress corrosion cracking and consequential missile generation than most other discs. The 14 number 6 discs currently on site (six operating rotors plus a spare rotor, each with two #6 discs) have individual missile generation probabilities ranging from 6×10^{-7} to 4×10^{-12} (for 60 months operation, probability of failure over entire period).~~

~~3.5.1.3.4 Turbine System Maintenance Program South Texas has established a turbine maintenance program which focuses on maintaining the probability of missile generation below 10^{-4} per year. The program requires inspections, maintenance, calibration, and/or testing of the functional integrity of turbine components at specified intervals. The components that are included in this program are the Low Pressure Turbine Rotors, Turbine Valves, Electrical Overspeed Protection device and Mechanical Overspeed device.~~

~~The Low Pressure Turbine Rotors are subjected to non-destructive examination at predetermined intervals. The intervals are unique to each set of rotors and may be different for replacement rotors, hence, is determined on a rotor specific basis.~~

~~The inspection intervals have been determined such that the missile generation probability is less than 10^{-4} per year. In the event the probability falls between 10^{-4} and 10^{-3} per year, the turbine may be kept in service until the next scheduled outage, at which time action can be taken to reduce the probability to meet the 10^{-4} per year limit before returning the turbine to service.~~

~~The turbine stop, governor, reheat stop, and intercept valves are tested once per quarter in Modes 1 and 2 per surveillance procedure to verify operability. One of each type of these valves is disassembled and inspected at least once per 40 months. Valve seats, discs, and stems receive a visual and surface inspection and are verified as having no unacceptable flaws or excessive corrosion. If unacceptable flaws or excessive corrosion are found, all other valves of that type shall be inspected.~~

~~The electrical overspeed device is calibrated at least once every eighteen months.~~

~~The mechanical overspeed trip is tested during turbine startup under the turbine startup procedure following each major turbine outage. The mechanical overspeed device will be tested quarterly via oil simulation while the turbine is operating.~~

~~3.5.1.3.5 Summary and Conclusions: The results of the turbine missile analysis have demonstrated that the probability of damage to safety related components is less than 10^{-7} per year, which satisfies regulatory requirements. This probability is maintained below this value by maintaining the probability of turbine missile generation below 10^{-4} per year, which is accomplished by the South Texas Turbine System Maintenance Program described in section 3.5.1.3.4.~~

Technical Requirements Manual (delete specification and associated Bases)

~~LIMITING CONDITION FOR OPERATION~~

~~3.3.4 At least one Turbine Overspeed Protection System shall be OPERABLE.~~

~~APPLICABILITY: MODES 1, 2, and 3.~~

~~ACTION:~~

~~a. With one stop valve or one governor valve per high pressure turbine steam line inoperable and/or with one reheat stop valve or one reheat intercept valve per low pressure turbine steam line inoperable, restore the inoperable valve(s) to OPERABLE status within 72 hours, or close at least one valve in the affected steam line(s) or isolate the turbine from the steam supply within the next 6 hours.~~

~~b. With the above required Turbine Overspeed Protection System otherwise inoperable, within 6 hours isolate the turbine from the steam supply.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.3.4.1 The provisions of Specification 4.0.4 are not applicable.~~

~~4.3.4.2 The above required Turbine Overspeed Protection System shall be demonstrated OPERABLE:~~

~~a. At least once per quarter in MODES 1 and 2 when the main turbine is operating by cycling each of the following valves through at least one complete cycle from the running position:~~

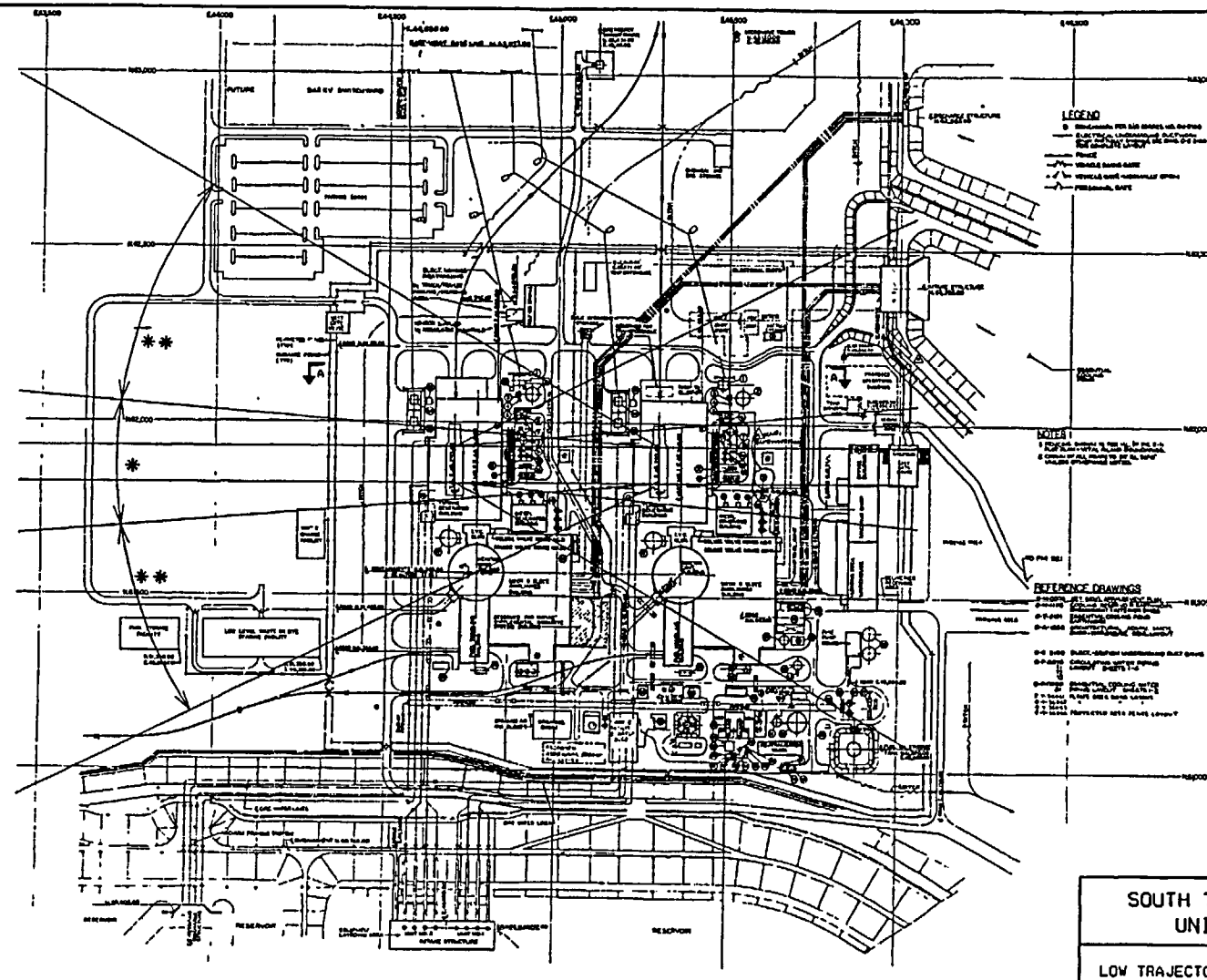
~~1) Four high pressure turbine stop valves,~~
~~2) Four high pressure turbine governor valves,~~
~~3) Six low pressure turbine reheat stop valves, and~~
~~4) Six low pressure turbine reheat intercept valves.~~

~~b. At least once per quarter in MODES 1 AND 2 when the main turbine is operating by direct observation of the movement of each of the above valves through one complete cycle from the running position,~~

~~c. At least once per 18 months by performance of a CHANNEL CALIBRATION on the Turbine Overspeed Protection Systems, and~~

~~d. At least once per 40 months by disassembling at least one of each of the above valves and performing a visual and surface inspection of valve seats, disks, and stems and verifying no unacceptable flaws or excessive corrosion. If unacceptable flaws or excessive corrosion are found, all other valves of that type shall be inspected.*~~

~~* Disassembly and inspection of the low pressure turbine reheat intercept valves are not required prior to the end of the first 40 month interval.~~



* -STRIKE ZONE FOR *1, 2, 3, 4, & 5 DISCS

** -STRIKE ZONE FOR *6 DISCS

SOUTH TEXAS PROJECT
UNITS 1 & 2

LOW TRAJECTORY TURBINE MISSILE
STRIKE ZONE

FIGURE 3.5-1 REVISION 4

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