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Technical Report

Probabilistic Evaluation of Turbine Valve Test Frequency

South Texas Project, Units 3&4

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Sept.28, 2010

Approved by
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Turbine Design & Assembling Dept.

Toshiba Corporation
KEIHIN PRODUCT OPERATION

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1. EXECUTIVE SUMMARY

The purpose of this report is to provide the detailed probabilistic basis for the valve test interval. The annual probability of turbine missile ejection has been calculated using detailed nuclear turbine operating data from Japanese nuclear power stations which use Toshiba turbine generators. Testing of turbine valves affects the probability that the valves will be incapable of closing given that the load on the turbine is lost. The failure or unavailability of the turbine valve safety function affects or contributes to the probability that the turbine will overspeed and eject a missile.

Turbine missiles can be ejected at overspeeds that are less than the destructive or runaway speed of the turbine. The current study has attempted to quantify the total risk of turbine missile ejection at destructive (Approximately [ ] percent of rated turbine speed) and at lower overspeeds. The lower overspeeds were evaluated in two categories: design overspeed and intermediate overspeed. The total missile ejection risk is developed in this report as the sum of the missile ejection probabilities from each of the three overspeed categories. Section 5 of this report discusses the basis for the analysis of turbine overspeed.

Section 6 of this report contains the detailed results of the probabilistic investigation.

The evaluation showed that the probability of turbine missile generation with quarterly valve testing is less than the evaluation criteria.

2. INTRODUCTION

In recognition of the effects of turbine valve testing on the probability of low pressure turbine missile ejection, Toshiba Corporation evaluated the need for periodic valve testing and to establish appropriate test intervals. This report contains the results of that evaluation.

The evaluation performed consisted of estimation of component failure rate and the annual probability of missile ejection. Failures of turbine valves and overspeed protection components were evaluated on the basis of Japanese nuclear steam turbine operating experiences. The annual probability of missile ejection was calculated for various test intervals.

3. TURBINE VALVE TESTING AND IMPACT

Testing is conducted to verify that equipment is capable of performing its intended function. The turbine valves function to control and protect the main turbine. They must be capable of moving freely in response to control and protection signals. Valve testing ideally tests these abilities or detects non-performance of these abilities including the associated active components of the EHC system. There are two degrees of performance or non-performance that testing may potentially demonstrate:

1. Equipment failure - the complete non-performance of equipment function.

2. Equipment failure precursors - identification of equipment conditions that will eventually lead to failure if not corrected.

A test which only identifies equipment failure is useful in limiting the time after failure that the faulty equipment may be relied on. A test which identifies failure precursors can impact the time between and the number of failures if the precursors are acted on. This section of the report addresses turbine valve testing and its implications on valve failure rate.

3.1 TURBINE VALVE TESTING

Periodic testing of turbine valves consists of movement of each of the turbine valves. Typically, this test is conducted by the control room operator. Valve testing verifies freedom of movement of the valve stem and plug, the actuator rod and piston and verifies proper operation of either the servo valve, servo, or motor, depending on which valve is being tested, and the associated drain line (return line) to the reservoir. Testing verifies smooth movement and operability of the valves.

In addition to periodic testing, valve tests and inspections during a shutdown can detect distress or conditions that would lead to future valve failure. In the current study, the valve inspection interval was not an input parameter. However, actual service experience has been used in the calculation of valve failure rates (Section 6). It is believed that these failure rates reflect the normal practice with respect to inspection and maintenance of turbine valves.

3.2 SURROGATE VALVE TESTING

Periodic valve testing primarily demonstrates the ability of the valve to respond to a signal and close upon demand. Both planned and unplanned turbine trips can also demonstrate these abilities and can be considered as surrogate valve tests for which a valve test "credit" can be taken, since all turbine trips result in the dumping of emergency trip oil and the operation of systems which dump high pressure oil or hydraulic fluid from the turbine valve actuators.

For both planned and unplanned trips, if plant operators observe the valve operation with its position indicator during the trip and verify there has been no evidence of malfunction of control or valves, then this operator activity would be qualified as a surrogate valve test.

3.3 VALVE FAILURE MODES AND IMPACT OF TESTING

The dominant occurrence of valve failure modes, such as sticking and mechanical damage, can be attributed to the following:

1. Movement or loss of valve internal components including the quality of EHC fluid
2. Cracking or breaking of the valve seat
3. Piston seal ring-bonnet, bushing, or liner galling or distress
4. Misalignment of valve linkage

These conditions are primarily internal to the valves, and periodic testing would identify these conditions only to the extent that they are apparent to an operator or that they prevent valve operation. Periodic testing most often identifies failures. Failure precursors that do not noticeably affect the rate of closure or final position of a valve are not easily detected in testing. For example, a cracked valve seat could potentially result in later valve seat failure and subsequent internal valve binding; however, the "precursor" could not be detected during testing, only the subsequent failure of the valve could be detected. However, the valve testing is effective to increase reliability of the overspeed protection system.

4. DESCRIPTIONS OF TURBINE VALVES AND OVERSPEED CONTROLS

The following sections describe the turbine valves and its control system. The turbine valve arrangement for STP-34 is shown in Figure 5-1.

4.1 TURBINE VALVES

Main stop valves and control valves, and intercept and intermediate stop valves are located in the steam lines to the high and low pressure turbines, respectively.

Main stop valves close automatically in response to the dumping oil of emergency trip system (ETS) which will occur in an overspeed trip or a system separation. The controls and trips that dump emergency trip oil are discussed in Section 4.2. In normal operation, each main stop valve is held open against a closing spring force by high pressure oil acting on the servo-actuator piston. Each main stop valve has a disc dump valve that opens if the ETS pressure is dumped. This in turn, routes the high pressure oil to drain and the main stop valve, equipped with large closing springs, closes rapidly.

Control valves adjust the inflow of steam to the turbine in response to the speed or load demand placed on the turbine-generator. Each has a servo valve and a disc dump valve. The servo valve receives an electrical input from the electronic controller and positions the steam valve through the control of high pressure oil to the servo-actuator. The electronic controller is a digital processor receiving turbine speed and reactor dome pressure inputs. The control valve will move rapidly to the fully-closed position if the disc dump valve is opened by a trip or protective device that dumps the oil of relayed emergency trip system (RETS). Various controls and trips, discussed in Section 4.2, are designed to dump the oil of RETS on loss of load or overspeed.

Intercept and intermediate stop valves are held open by high pressure oil operating on the pistons of the servo-actuators. Each intercept valve has a disc dump valve that is connected to RETS oil header.

The disc dump valves will open in response to a dump of the emergency trip oil and close the intercept valves, Intermediate stop valves have disc dump valves that are connected to ETS oil header.

The intermediate stop valves will close in response to a dump of ETS oil.

4.2 TURBINE CONTROL AND OVERSPEED PROTECTION

The digital electrohydraulic control (D-EHC) control system controls the flow of steam to the turbine and permits the selection of the desired turbine speed and acceleration rates. The primary speed channel and reactor dome pressure are the primary inputs to the valve electronic controller, which positions the control valves. If the turbine accelerates from its normal speed, the normal speed control system and servo valve on each control valve will rapidly reduce the oil pressure acting on the control valve servo-actuators. This causes the control valves to close until the turbine returns to normal speed.

The following additional overspeed protection controls are provided to prevent overspeed.

First, the power-load unbalance (PLU) will activate after a loss of load if the load unbalance exceeds approximately 40%, and automatically energizes fast acting solenoid valves that will drain the emergency trip oil and cause the CVs and IVs to fast close.

Second, a primary overspeed trip system will trip the turbine at approximately 110% speed. The primary overspeed trip system has three separate speed pickups with independent circuits, separate power supplies, 2 out of 3 trip logic, and separate trip solenoid valve to drain emergency trip oil to cause MSVs, CVs, ISVs, and IVs to close.

Lastly, an emergency overspeed trip system is also provided. It uses separate speed sensors, separate power supplies, 2 out of 3 trip logic, and will trip its trip solenoid at approximately 111% speed, to drain emergency trip oil to cause MSVs, CVs, ISVs, and IVs to close. The emergency ovespeed trip system is diverse, separate, and independent from the primary trip system.

In the event of a turbine trip prior to a generator trip, the opening of generator output breakers is delayed following the turbine trip. Experience has shown that without being loaded by the generator, residual steam energy can cause turbines to overspeed. Immediately following a turbine trip, with the steam supply cut off, the turbine is allowed to motor with turbine speed governed by grid frequency. This allows remaining steam to be exhausted and steam lines depressurized prior to a generator trip (removal of load).

5. BASIS FOR ANALYSIS

5.1 TURBINE VALVE ARRANGEMENT AND CONTROL OIL SYSTEM

Figure 5-1 describes the turbine valves on the steam inflow lines to the high pressure turbine and the low pressure turbine.

The steam turbine for STP-34 plant in the study has the D-EHC system. Appendix A shows the applicable control oil system drawing.

The trip components were described in Section 4 of this report. The control oil system for STP-34 steam turbine has overspeed trip systems, which dump the emergency trip oil in a manner to close all the steam valves including MSV, CV, ISV and IV. The dump of emergency trip oil causes an emergency trip valve to open, which dumps the emergency trip oil for the MSVs & ISV and emergency trip oil for the CVs & IVs.

This system also includes relay trip valve which will dump the emergency trip oil for the CVs & IVs.

5.2 IDENTIFICATION OF OVERSPEED EVENTS

Before discussing the type of overspeed events that are of concern in this study, it should be pointed out that turbine overspeed is sometimes planned for the purpose of testing overspeed trip mechanisms. The test conditions can be controlled so that during trip testing the turbine speed is between rated speed and 110% speed of rated speed, trip set point. The risk of missile ejection at the overspeed trip set point (110&111 percent of rated speed) is small and was not evaluated in this study. The current study focuses on overspeed events that occur inadvertently following a system separation or loss of load. These events generally involve system failure sequences causing overspeeds that approach or exceed the design overspeed of the turbine.

"Design overspeed," "Intermediate overspeed" and "Destructive overspeed" were taken into consideration in this study.

The "Design overspeed" event is one in which the maximum speed of the turbine approaches but does not exceed an overspeed of 120 percent of rated speed. "Design overspeed" will be approached if the overspeed protection controller or the control valves or intercept valves fail to function and the main stop and intermediate stop valves close after turbine speed reaches the overspeed trip setpoint.

The following is a description of the basis for "Design overspeed":

1. System separation occurs
2. One or more control valves, or one or more intercept valves, fail to close immediately following loss of load
3. Successful overspeed trip: the main stop valves and intemediate stop valves close

"Intermediate overspeed" has been estimated to be approximately 10 percent above design overspeed. Generally, intermediate overspeed involves a failure to block to the low pressure turbine. The failure of the intermediate stop and intercept valves to close at the overspeed trip setpoint results in a transfer of energy to the low pressure turbine for a longer duration than what occurs in design overspeed.

The following is a description of the basis for "Intermediate overspeed" for the turbine:

1. System separation occurs
2. One or more alignments of ISV/IV remain open

"Destructive overspeed" results from failure of one or more main stop valves to close and failure of one or more control valves downstream of the failed main stop valve. Destructive overspeed is on the order of [ ] percent of rated speed. Failure of ISV or IV has no impact on this event. The following is an abbreviated description of the basis for "Destructive overspeed":

1. System separation occurs
2. One or more control valves fail to close
3. One or more main stop valves fail to close

5.3 BASIS FOR CALCULATION OF MISSILE, EJECTION PROBABILITIES

The regular testing of turbine valves and the regular inspection of the low pressure turbine rotors during normal maintenance are two effective ways of controlling and managing the risk of turbine missile ejection. The main goal of this sturdy was to determine the effect of turbine valve test interval on the probability of turbine missile ejection (which is discussed separately in Reference 2). Turbine valve testing affects only the probability of missile ejection resulting from overspeed of the turbine. Therefore, this study concentrated on missile ejection from overspeed.

Before discussing the basis for calculating the probability of missile ejection due to overspeed, it should be mentioned that all of the plants have a program of low pressure rotor inspection. In the deterministic program, the LP rotors are inspected during normal maintenance. The time that it takes for a hypothetical crack in the rotor to grow to critical size (the crack size that is just large enough to result in rotor failure with probability of 1.0E-05) is calculated. The inspection interval is established to be less than this probabilistic failure time.

The effect of varying the turbine valve test interval was evaluated by calculating the total probability of turbine missile ejection, P, for the three identified overspeed events. The formula used to calculate P is reproduced in Table 5-1 and is discussed in the following paragraphs.

The probability of missile ejection due to design overspeed is the product of the probability of design overspeed, P(A), and the conditional probability of missile ejection at design overspeed, P(M/A). In other words, P(M/A) is the probability of ejecting a missile given that the turbine reaches design overspeed. A product of P(B) and P(M/B) results in the probability of missile ejection for the intermediate overspeed event. P(C) by itself denotes the probability of missile ejection for the destructive overspeed event because the conditional probability, P(M/C), is assumed to be one in the study.

P(M/A) was obtained from probabilistic reports on missile ejection from fully integral low pressure turbine rotors (Reference 2). It involves a calculation of the probability of failure of low pressure turbine rotor based on TOSHIBA Corporation crack growth data, the stress generated at design overspeed, and the resultant critical crack size.

The probability of low pressure turbine rotor failure is broken into two parts: the probability that a crack initiates and the probability that the crack has grown beyond critical size after a certain interval of time.

Section 4 of Reference 2 shows the probability of missile ejection depending on safety related inspection intervals and concludes that the probability of missile ejection from fully integral rotor with low yield strength is extremely low when the rotor rotating speed is suppressed under "Design overspeed" or "Intermediate overspeed."

Based on the above discussion, it can be concluded that probability of P(A) ∗ P(M/A) and P(B) ∗ P(M/B) is negligibly small compared to P(C) in case of full integral rotor with low yield strength, which will be applied to STP-34 low pressure turbine rotor.

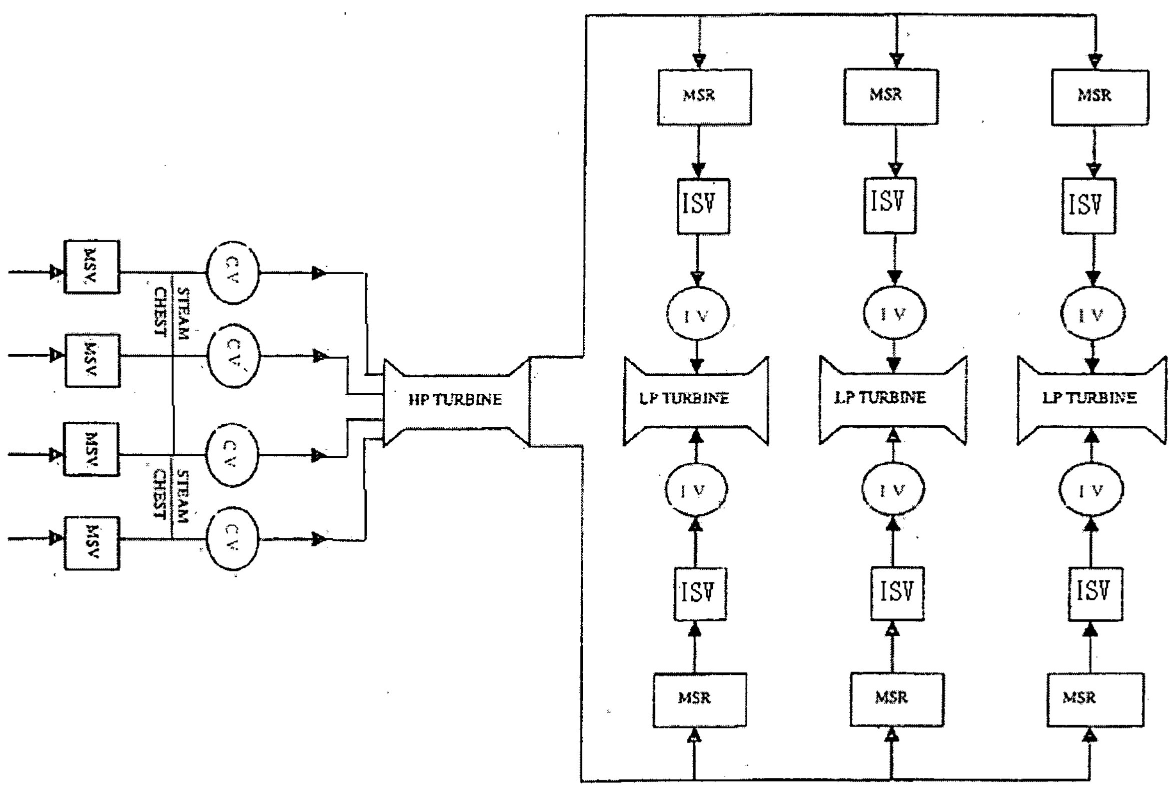
Section 6 of this report gives the detailed results of the evaluation of P for the various turbine valve test intervals.

5.4 ASSUMPTIONS (BASIS FOR ANALYSIS)

The assumptions below pertain to the basis for analysis:

- The design overspeed events are assumed to result in 120 percent overspeed even though it is likely that the actual overspeed would be less. This gives additional conservatism to the analysis.
- P(A) ∗ P(M/A) and P(B) ∗ P(M/B) is negligibly small compared to P(C) and these probability can be regarded as zero (0).
- P(C) is the annual probability of destructive overspeed results from failure of one or more main stop valves to close and failure of one or more control valves downstream of the failed main stop valve. Failure of ISV or IV is assumed to have no impact on this event.

Table 5-1 Basis for Calculation of P(Resulting From Turbine Overspeed)	
P=P(A)*P(M/A)+P(B)*P(M/B)+P(C)	
Where:	
P	Annual probability of turbine missile ejection
P(A)	Annual probability of design overspeed
P(B)	Annual probability of intermediate overspeed
P(C)	Annual probability of destructive overspeed
P(M/A)	Conditional probability of missile ejection at design overspeed
P(M/B)	Conditional probability of missile ejection at intermediate overspeed



Legend

MSV : Main Stop Valve
CV : Control Valve
ISV : Intermediate Stop Valve
IV : Intercept Valve
MSR : Moisture Separation Reheater

Figure 5-1 Arrangement of Turbine Valves

6. FAILURE DATA AND ANALYSIS OF BASIC FAILURE PROBABILITY

6.1 SOURCES OF FAILURE DATA AND METHOD OF ANALYSIS

The primary source of basic failure data in this study was from the operating experience of TOSHIBA Corporation nuclear steam turbines. A total of 10 nuclear units data was used for this study.

The basic service experience data and years of service, is given in Table 6-1 and Table 6-2.

6.2 DETERMINATION OF FAILURE RATE OF EACH COMPONENT

Failure rates of each component including main stop valve (MSV), MSV control system, control valve (CV) and CV control system were obtained based on the following equation and calculated results with *95%* confidence are shown in Table 6-3.

Failure Rate	:	$\lambda(\alpha)/2$
$\lambda(\alpha)$	:	$\chi^2(\phi, 1-\alpha)/T$
χ^2	:	Chi square distribution
T	:	Accumulated operating hours
ϕ	:	Degree of freedom=2f+2
f	:	Number of observed failure

6.3 DETERMINATION OF ANNUAL PROBABILITY OF TURBINE MISSILE EJECTION

According to the discussion in Section *5* in this study, probability of turbine missile ejection for STP-34 was determined by the following equations.

Table 6-5 demonstrates the calculated results showing the relationship between annual probability of turbine missile ejection and time interval of valve tests.

System Separation Rate, Qss, is evaluated based on 10 Japanese BWR nuclear plant experiences. Tables 6-1 and 6-2 show the number of system separations that occurred during turbine on-load conditions and the accumulated operating hours of the 10 BWR units. These data lead to the conclusion that the probability of system separation during operation is [ ]. In order to make the evaluation conservative, ten (10) times the probability of system separation above, is [ ], is adopted in this evaluation.

$$P = N*4*(Q_{SV} + Q_{SC})*(Q_{CV} + Q_{CC})*Q_{SS}$$

P	:	Probability of turbine missile ejection	1/Time Interval
Q_{SV}	:	Failure Probability of MSV = $q_{SV}/2n$	1/Time Interval
Q_{SC}	:	Failure Probability of MSV control system = $q_{SC}/2n$	1/Time Interval
Q_{CV}	:	Failure Probability of CV = $q_{CV}/2n$	1/Time Interval
Q_{CC}	:	Failure Probability of CV control system = $q_{CC}/2n$	1/Time Interval
Qss	:	System Separation Probability	1/Time Interval

N	:	Number of main steam pipes	—
n	:	Number of valve tests per month	—
q_{SV}	:	Failure rate of MSV	per month
q_{SC}	:	Failure rate of MSV control system	per month
q_{CV}	:	Failure rate of CV	per month
q_{CC}	:	Failure rate of CV control system	per month

Where, "Time Interval" denotes "Time Interval between Valve Tests"

Table 6-1 Basic Service Experience Data in Japanese Nuclear Power Stations						
Unit Name		MSV Fault	CV Fault	MSV Control System Fault	CV Control System Fault	System Separation
1	ONAGAWA NO.1					
2	ONAGAWA NO.2					
3	HIGASHIDORI NO.1					
4	#1FUKUSHIMA NO.3					
5	#1FUKUSHIMA NO.5					
6	#2FUKUSHIMA NO.1					
7	#2FUKUSHIMA NO.3					
8	KASHIWAZAKI NO.1					
9	KASHIWAZAKI NO.2					
10	KASHIWAZAKI NO.3					
TOTAL (As of 3/31/2009)						

Table 6-2 Years of Service for Unit and Component in Japanese Nuclear Power Stations						
Unit Name	Output (MW)	Accumulated Operating Hours of Unit (Note 1,2) (hr)	Number of MSV (-)	Number of CV (-)	MSV Component Accumulated Operating Hours (hr)	CV Component Accumulated Operating Hours (hr)
ONAGAWA NO.1						
ONAGAWA NO.2						
HIGASHIDORI NO.1						
#1FUKUSHIMA NO.3						
#1FUKUSHIMA NO.5						
#2FUKUSHIMA NO.1						
#2FUKUSHIMA NO.3						
KASHIWAZAKI NO.1						
KASHIWAZAKI NO.2						
KASHIWAZAKI NO.3						
TOTAL						

Note-1 : Accumulated Operating Hours of Unit includes trial operation hours

Note-2 : Accumulated Operating Hours of Unit as of 2009.3.31

Table 6-3 Failure Rate of Each Components (95% Confidence)

Component	T: Accumulated Operating Hours (hr)	f: Number of Failures (-)	Failure Rate	
			Mean (-/hr)	Upper Limit (95% Confidence) {-/hr}
MSV				
MSV Control System				
CV				
CV Control System				
System Separation				

Note : Failure Rate derived based on following equations
Failure Rate (Mean) = f (Number of Failure)/T (Accumulated Operating Hours)
Failure Rate (Upper Limit) = $\lambda(\alpha)/2$

Table 6-4 Upper Limit Failure Rates

	Unit	MSV	MSV Control System	CV	CV Control System	System Separation
F: Number of Failure						
ϕ : Degree of Freedom = 2f+2						
$\chi^2(\phi, 1-\alpha)$						
T: Accumulated Operating Hours						
$\lambda(\alpha)=\chi^2(\phi,1-\alpha)/T$						
Failure Rate (Upper Limit) = $\lambda(\alpha)/2$						

Table 6-5 Annual Probability of Turbine Missile Ejection (95% Confidence)

Time Interval Between Turbine Valve Tests = 1 (Month)

		Unit	MSV	MSV Control	CV	CV Control
Failure Rate (Upper Limit)	q	per Hour				
		per Month				
Frequency of Valve Test	n	per Month				
Time Interval of Valve Test		Month				
Probability of Failure	Q=q/2n	1/(Time Interval)				
	(Q_{SV}+Q_{SC}) or (Q_{CV}+Q_{CC})	1/(Time interval)				
Probability of System Separation	Q_{SS}	per hour				
		1/(Time Interval)				
Probability of Turbine Missile	P	1/(Time Interval)				
		per Year				

Time Interval Between Turbine Valve Tests = 2 (Month)

		Unit	MSV	MSV Control	CV	CV Control
Failure Rate (Upper Limit)	q	per Hour				
		per Month				
Frequency of Valve Test	n	per Month				
Time Interval of Valve Test		Month				
Probability of Failure	Q=q/2n	1/(Time Interval)				
	(Q_{SV}+Q_{SC}) or (Q_{CV}+Q_{CC})	1/(Time Interval)				
Probability of System Separation	Q_{SS}	per hour				
		1/(Time Interval)				
Probability of Turbine Missile	P	1/(Time Interval)				
		per Year				

Time Interval Between Turbine Valve Tests = 3 (Month)

		Unit	MSV	MSV Control	CV	CV Control
Failure Rate (tipper Limit)	q	per Hour				
		per Month				
Frequency of Valve Test	n	per Month				
Time Interval of Valve Test		Month				
Probability of Failure	Q=q/2n	1/(Time Interval)				
	(Q_{SV}+Q_{SC}) or (Q_{CV}+Q_{CC})	1/(Time Interval)				
Probability of System Separation	Q_{SS}	per hour				
		1/(Time Interval)				
Probability of Turbine Missile	P	1/(Time Interval)				
		per Year				

Table 6-5 Annual Probability of Turbine Missile Ejection (95% Confidence) (cont.)

Time Interval Between Turbine Valve Tests =6 (Month)

		Unit	MSV	MSV Control	CV	CV Control
Failure Rate (Upper Limit)	q	per Hour				
		per Month				
Frequency of Valve Test	n	per Month				
Time Interval of Valve Test		Month				
Probability of Failure	Q=q/2n	1/(Time Interval)				
	$(Q_{SV}+Q_{SC})$ or $(Q_{CV}+Q_{CC})$	1/(Time Interval)				
Probability of System Separation	Qss	per hour				
		1/(Time Interval)				
Probability of Turbine Missile	P	1/(Time Interval)				
		per Year				

Time Interval Between Turbine Valve Tests = 12 (Month)

		Unit	MSV	MSV Control	CV	CV Control
Failure Rate (Upper Limit)	q	per Hour				
		per Month				
Frequency of Valve Test	n	per Month				
Time Interval of Valve Test		Month				
Probability of Failure	Q=q/2n	1/(Time Interval)				
	$(Q_{SV}+Q_{SC})$ or $(Q_{CV}+Q_{CC})$	1/(Time Interval)				
Probability of System Separation	Qss	per hour				
		1/(Time Interval)				
Probability of Turbine Missile	P	1/(Time Interval)				
		per Year				

Figure 6-1 Annual Probability of Turbine Missile Ejection (95% Confidence)

7. CONCLUSION

Turbine valve testing is performed at an interval that achieves a turbine missile probability rate P of 1.0E-05 or less per year. From Table 6-5 above, the resulting turbine missile probability rate is [ ] per year with a 3 month valve test interval. This value is below the evaluation criteria of 1.0E-05 or less per year.

Therefore it can be shown that a 3 month valve testing interval can be implemented and meet the evaluation criteria of <1.0E-05 per year*.

* This acceptance criteria is the same as the value of P1 which comes from NUREG-0800, SRP 3.5.1.3, Table 3.5.1.3-1 for an unfavorably oriented turbine. It represents the general, minimum reliability requirement for loading the turbine and bringing the system on line.

References

1. H. L. Ornstein, "Operating Experience Feedback Report - Turbine - Generator Overspeed Protection Systems Commercial Power Reactors", U.S. Nuclear Regulatory Commission, NUREG-1275 Vol. 11, 1995.

2. [Tominaga, J., "Analysis of the Probability of the Generation of Missiles from Fully Integral Nuclear Low Pressure Turbines", UTLR-0008-P, 2010]

APPENDIX A

CONTROL OIL DIAGRAMS

AND

OVERVIEW OF THE TURBINE OVERSPEED CONTROL SYSTEM

Affidavit for Withholding Confidential and Proprietary Information from Public Disclosure under 10 CFR § 2.390

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of

STP Nuclear Operating Company — Docket Nos.52-012, 52-013

South Texas Project
Units 3 and 4

AFFIDAVIT

I, Takashi Suzuki, being duly sworn, hereby depose and state that I am Chief Specialist, Turbine Design & Assembling Department, Keihin Product Operations, Power Systems Company, TOSHIBA CORPORATION, that I am duly authorized by TOSHIBA CORPORATION to sign and file with the Nuclear Regulatory Commission the following application for withholding TOSHIBA CORPORATION's confidential and proprietary information from public disclosure; that I am familiar with the content thereof; and that the matters set forth therein are true and correct to the best of my knowledge and belief.

In accordance with 10 CFR § 2.390(b)(ii), I hereby state, depose, and apply as follows on behalf of TOSHIBA CORPORATION:

(A) TOSHIBA CORPORATION seeks to withhold from public disclosure the documents listed in Attachment 1 of this affidavit, and all information identified as "Toshiba Proprietary Information" therein (collectively, "Confidential Information").

(B) The Confidential Information is owned by TOSHIBA CORPORATION. In my position as Chief Specialist, Turbine Design & Assembling Department, Keihin Product Operations, Power Systems Company, TOSHIBA CORPORATION, I have been specifically delegated the function of reviewing the Confidential Information and have been authorized to apply for its withholding on behalf of TOSHIBA CORPORATION.

(C) The reports listed in Attachment 1 provide technical justification of overspeed protection philosophy for the turbine manufactured by TOSHIBA CORPORATION. Specifically, the justification includes both missile generation probability from Low Pressure Turbine and Test frequency of associated steam shut off valves based on TOSHIBA CORPORATION's operating experience. The Confidential Information which is entirely confidential and proprietary to TOSHIBA CORPORATION is indicated in the document using brackets.

(D) Consistent with the provisions of 10 CFR § 2.390(a)(4), the basis for proposing that the Confidential Information be withheld is that it constitutes TOSHIBA CORPORATION's trade secrets and confidential and proprietary commercial information.

(E) Public disclosure of the Confidential Information is likely to cause substantial harm to TOSHIBA CORPORATION's competitive position and its business relations with the turbine-pump vendor by (1) disclosing confidential and proprietary information about the methodology or database for evaluating reliability of nuclear steam turbine and associated components to other parties whose commercial benefit may be adverse to those of TOSHIBA CORPORATION, and (2) giving such parties access to and use of such information at little or no cost, in contrast to the significant costs incurred by TOSHIBA CORPORATION to develop such information.

TOSHIBA CORPORATION has a rational basis for determining the types of information customarily held in confidence by it, and utilizes a system to determine when and whether to hold certain types of information in confidence.

The basis for claiming the information so designated as proprietary is as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of TOSHIBA CORPORATION's competitors without license from TOSHIBA CORPORATION constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of TOSHIBA CORPORATION, its customers or suppliers.

(e) It reveals aspects of past, present, or future TOSHIBA CORPORATION or customer funded development plans and programs of potential commercial value to TOSHIBA CORPORATION.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the TOSHIBA CORPORATION system which include the following:

(a) The use of such information by TOSHIBA CORPORATION gives TOSHIBA CORPORATION a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the TOSHIBA CORPORATION competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the TOSHIBA CORPORATION ability to sell products and services involving the use of the information.

(c) Use by our competitor would put TOSHIBA CORPORATION at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving TOSHIBA CORPORATION of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of TOSHIBA CORPORATION in the world market, and thereby give a market advantage to the competition of those countries.

(f) The TOSHIBA CORPORATION capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

Further, on behalf of TOSHIBA CORPORATION, I affirm that:

(i) The Confidential Information is confidential and proprietary information of TOSHIBA CORPORATION.

(ii) The Confidential Information is information of a type customarily held in confidence by TOSHIBA CORPORATION, and there is a rational basis for doing so given the sensitive and valuable nature of the Confidential Information as discussed above in paragraphs (D) and (E).

(iii) The Confidential Information is being transmitted to the NRC in confidence.

(iv) The Confidential Information is not available in public sources.

(v) Public disclosure of the Confidential Document is likely to cause substantial harm to the competitive position of TOSHIBA CORPORATION, taking into account the value of the Confidential Information to TOSHIBA CORPORATION, the amount of money and effort expended by TOSHIBA CORPORATION in developing the

Confidential Information, and the ease or difficulty with which the Confidential Information could be properly acquired or duplicated by others.

T. Suzuki

Sep. 28, 2010

Takashi Suzuki
Chief Specialist
Turbine Design & Assembling Department
Keihin Product Operations
Power Systems Company
TOSHIBA CORPORATION

Attachment 1 to the Toshiba Affidavit to the NRC

(Proprietary Information)

DOCUMENTS ENCLOSED (TO BE WITHELD FROM PUBLIC DISCLOSURE PER 2.390)

Item	Document Description	Document Number	Rev
1.	Analysis of the Probability of the Generation of Missiles from Fully Integral Nuclear Low Pressure Turbines (Proprietary Version)	UTLR-0008-P	1
2.	Probabilistic Evaluation of Turbine Valve Test Frequency (Proprietary Version)	UTLR-0009-P	1

認　　　証

嘱託人株式会社東芝主幹鈴木孝史は、公証人の面前で、添付書面に署名した。

よって、これを認証する。
平成２２年　9 月　28　日、本公証人役場において

横浜地方法務局所属
公　証　人
Notary

KENJI TERANISHI

証　　　明

上記署名は、横浜地方法務局所属公証人の署名に相違ないものであり、かつ、その押印は、真実のものであることを証明する。
平成２２年　9 月　28　日

横浜地方法務局長　　　　檜　栄一

APOSTILLE

(Convention de La Haye du 5 octobre 1961)

1. Country : JAPAN
   This public document
2. has been signed by KENJI TERANISHI
3. acting in the capacity of Notary of the Yokohama District Legal Affairs Bureau
4. bears the seal/stamp of KENJI TERANISHI , Notary

Certified

5. at Tokyo　　　　6. SEP. 28. 2010
7. by the Ministry of Foreign Affairs
8. 10-№ 300549
9. Seal/stamp :　　　　10. Signature :

Kazutoyo OYABE

For the Minister for Foreign Affairs

Registered No. 125 of 2010.

Certificate of Acknowledgment of Notary

On this 28th day of September, 2010, before me, KENJI TERANISHI, a notary in and for YOKOHAMA District Legal Affairs Bureau, personally appeared TAKASHI SUZUKI, Chief Specialist of TOSHIBA CORPORATION, with satisfactory evidence of his identification, affixed his signature to the attached document.

Witness, I set my hand and seal.

Notary

Kenji Teranishi

KENJI TERANISHI

Notary's official seal

Kannai-odori Notary office

2-7-10, Hagoromo-cho, Naka-ku, Yokohama-city, Japan.

Attached to the Yokohama District Legal Affairs Bureau.