Attachment 4

5

CALLAWAY'S TURBINE OVERSPEED PROTECTION RELIABILITY PRCGRAM

1.1

TOPRP March 16, 1984 Revision 2

CALLAWAY PLANT TURBINE OVERSPEED PROTECTION RELIABILITY PROGRAM

RESP. DEPT.	ASST MAR	Oim	PREPARED BY	WRRdainsm
APPROVED BY	Attun	E./h.t.	thullinge	DATE 3-17-84
DATE ISSUED				

This procedure contains the following: -

Pages	1	through	12	
Attachments		through		
Appendices		through		
Checklist	le suise	through		

Proced.	No.	TOPRP	
Rev.		2	

Table of Contents

Section		Page Number
1.0	Introduction and Summary	1
2.0	Purpose and Scope	3
3.0	Definitions	3
4.0	Responsibilities	3
5.0	Procedure	4
6.0	Reporting	11
7.0	Records	11
8.0	Revisions to the Turbine Overspeed Protection Reliability Program	12
9.0	References	12

TURBINE OVERSPEED PROTECTION RELIABILITY PROGRAM

1.0 INTRODUCTION AND SUMMARY

- 1.1 The Union Electric Company "Turbine Overspeed Protection Reliability Program" (TOPRP) consists of a comprehensive program for turbine inspection and the maintenance, calibration and testing of the turbine overspeed protection system. This program is designed to provide assurance that flaws or component failures in the overspeed sensing and tripping subsystems, in the Main Stop Valves, Control Valves, Combined Intercept Valves, and Extraction Nonreturn Valves that might lead to an overspeed condition above the design overspeed rating will be detected and thus provide assurance of turbine integrity.
- 1.2 This program is based on recommendations by General Electric Company regarding valve maintenance, testing, inspection and calibration, operating experience at Nuclear Plants with similar units, operating experience at other Union Electric Company plants, and regulatory guidance. The objective of this program is to assure turbine integrity and to maintain maximum reliability of the turbine overspeed protection system.
 - 1.3 The testing program as presented in section 5.2.1 includes testing of the turbine overspeed protection system and the Main Stop, Control, Combined Intercept, & Extraction Nonreturn valves. Testing is performed during turbine startup, unless previously tested within the required test interval, including startup after each refueling outage.
 - 1.4 The maintenance and inspection program as presented in section 5.2.3 includes periodic inspection and maintenance of the turbine assembly, the Main Stop, Control, Combined Intercept, and Extraction Nonreturn Valves.

1.5 The calibration program as presented in section 5.2.2 consists of calibration of the turbine overspeed protection system at least once per 18 months or following major maintenance on the turbine overspeed protection system.

1.6

1.7

Union Electric Company's commitment to the Nuclear Plant Reliability Data System (NPRDS) as presented in section 6.0 will include the Main Stop, Control, Combined Intercept and Extraction Nonreturn Valves so that deficiences may be reported and reviewed and necessary revisions may be made to the Union Electric Company "Turbine Overspeed Protection Reliability Program" based on reliability data.

This integrated inspection, testing, calibration and maintenance program is the subject of on-going review and evaluation by Union Electric Company and is subject to revision based on operating data from this and other similar units or changes to the manufacturers recommendations. This program shall be implemented by the use of approved procedures, maintenance work requests and outage work schedules as appropriate. Deviations from this program or deficiencies identified during inspection, testing, calibration and maintenance will be evaulated by Union Electric Company and appropriate action taken. The "Turbinc Overspeed Protection Reliability Program" and any subsequent changes thereto shall be reviewed in accordance with Callaway Plant Administrative Procedures, the Callaway Plant Technical Specifications and implemented in accordance with the provisions of 10CFR50.59.

2.0 PURPOSE AND SCOPE

- 2.1 The purpose of the Turbine Overspeed Protection Reliability Program is to insure Turbine Rotor Integrity, operability of the Turbine Overspeed Protection System and overall reliability of the Main Turbine through a comprehensive periodic maintenance, calibration, testing and inspection program.
- 2.2 The Turbine Overspeed Protection Reliability Program shall include the inservice inspection programs for the Main Turbine and turbine valves including periodic valve cycling and valve diassembly in accordance with the manufacturers recommendations and general guidelines. Modifications may be made based on Union Electric Company's turbine operating experience for similar units, industry experience, or engineering evaluations.

3.0 DEFINITIONS

3.1 NUCLEAR PLANT RELIABILITY DATA SYSTEM (NPRDS)

Nuclear Plant Reliability Data System (NPRDS) is a computerized data base, managed by INPO, used to track and trend nuclear power plant equipment reliability.

- 4.0 RESPONSIBILITIES
- 4.1 NUCLEAR SAFETY REVIEW BOARD (NSRB)

The Nuclear Safety Review Board shall be responsible for review of safety evaluations for changes to this program in accordance with Callaway Plant Technical Specifications section 6.5.2.8.

4.2 MANAGER, CALLAWAY PLANT

The Manager, Callaway Plant shall be responsible for the review, approval, and implementation of the Turbine Overspeed Protection Reliability Program and changes thereto.

4.3 ON-SITE REVIEW COMMITTEE (ORC)

The On-Site Review Committee shall be responsible for review of the Turbine Overspeed Protection Reliability Program and changes thereto in accordance with Callaway Plant Technical Specifications Section 6.5.1.6 and this program.

4.4 ASSISTANT MANAGER, OPERATIONS AND MAINTENANCE

The Assistant Manager, Operations and Maintenace shall be responsible for:

- 4.4.1 Development of implementing procedures to meet the requirements of the Turbine Overspeed Protection Reliability Program.
- 4.4.2 Ensuring testing requirements of the Turbine Overspeed Protection Reliability Program are met or that the deviations are reviewed and approved in accordance with this program, Callaway Plant Administrative procedures and the Callaway Plant Technical Specifications.
- 4.4.3 Ensuring test results are reviewed against the acceptance criteria as specified in the implementing procedures and the initiation of remedial or corrective action in accordance with APA-ZZ-00500, "Nonconforming Operations Reporting and Corrective Actions", for unacceptable results.
- 5.0 PROCEDURE
- 5.1 PROGRAMMATIC
- 5.1.1 The Turbine Overspeed Protection Reliability Program shall be reviewed by the On-Site Review Committee and approved by the Manager, Callaway Plant prior to implementation.

- 5.1.2 Changes to the Turbine Overspeed Protection Reliability Program shall be reviewed by the Responsible Department Head and submitted for review by the On-Site Review Committee and approved by the Manager, Callaway Plant. Implementation of changes to the Turbine Overspeed Protection Reliability Program will be accomplished in accordance with Callaway Plant Technical Specifications.
- 5.1.3 Implementing procedures for the Turbine Overspeed Protection Reliability Program shall be written, reviewed, and approved in accordance with Callaway Plant Technical Specifications, Section 6.5.3, "Technical Review and Control," and Callaway Plant Administrative Procedure, APA-ZZ-00101, "Preparation, Review, Approval and Control of Plant Procedures."
- 5.1.4 Variation from the frequency requirements of the Turbine Overspeed Protection Reliability Program.
- 5.1.4.1 Variance from the turbine valve testing program as described in Section 4.2.1 shall be approved as follows:
- 5.1.4.1.1 No test frequency shall exceed 1.25 times the required test interval without prior approval of the Manager, Callaway Plant or the Emergency Duty Officer.
- 5.1.4.1.2 No more than two consecutive tests shall be deferred without the prior review of the On-Site Review Committee and approval by the Manager, Callaway Plant.

- 5.1.4.2 Variation from the test frequencies for those Turbine Overspeed Protection Reliability Program tests/inspections/calibrations as described in Sections 5.2.2, 5.2.3, and 5.2.4 shall be approved as follows:
- 5.1.4.2.1 No test frequency shall exceed 1.25 times the required test interval without an engineering evaluation performed in accordance with Callaway Plant Administrative Procedures, AFA-22-00140, "Conduct of Engineering & Safety Evaluations," reviewed by the On-Site Review Committee and approved by the Manager, Callaway Plant.

5.2 TECHNICAL

- 5.2.1 The inservice testing program for those components important to the turbine overspeed protection system shall include the following:
- 5.2.1.1 Turbine Generator Startup Testing each of the following tests shall be completed weekly and prior to each startup unless performed within the last 7 days as recommended by General Electric Company:
- 5.2.1.1.1 Mechanical Overspeed Trip Test during this test the Electrical Trip and Monitoring System energizes the Oil Trip Solenoid Valve which admits lubrication oil to the Overspeed Trip Device causing it to trip. A coordinated actuation of the Mechanical Lockout Solenoid Valve prevents the Emergency Trip System from actually tripping the turbine. This test should be completed just after the Backup Overspeed Trip test as shown in section 5.2.1.1.4.

- 5.2.1.1.2 Mechanical Trip Piston Test during this test the Electrical Trip and Monitoring System energizes the Mechanical Trip Solenoid Valve shunting oil from the piston causing it to trip. A coordinated actuation of the Mechanical Lockout Solenoid Valve prevents the Emergency Trip System from actually tripping the turbine.
- 5.2.1.1.3 Electrical Trip Test during this test the Electrical Trip and Monitoring system de-energizes both 24 VDC solenoids causing the Electrical Trip Valve System to trip. A coordinated actuation of the Electrical Lockout Solenoid Valve prevents the Emergency Trip System from actually tripping the turbine.
- 5.2.1.1.4 Backup Overspeed Trip Test during this test the logic circuits for the two-out-of-three logic are tested. Since each may be tested independently, no actual turbine trip occurs.
- 5.2.1.1.5 Thrust Bearing Wear Detector Test excessive wear of one thrust plate activates two pressure switches set at different levels of pressure, which correspond to different shaft displacements, the first representing an alarm level, and the second a trip. The pressure switch contacts are connected in series developing a two-out-of-two logic. During this test, a third series contact permits the trip line to be open preventing an actual turbine trip.
- 5.2.1.1.6 Power Load Imbalance Test during this test a load loss is simulated exercising the load imbalance circuitry. This test can only be performed when turbine load is greater than 40%.

- 5.2.1.2 Actual Turbine Trip Tests each of the following tests shall be performed at least once per 18 months or when major maintenance is performed on the turbine.
 - 5.2.1.2.1 Actual Turbine Trip during this test the turbine speed is allowed to increase to the trip setpoint of 109.5% causing mechanical and electrical trip actuation.
 - 5.2.1.2.2 Actual Back-up Overspeed Trip (BOST) Test during this test the turbine speed is allowed to increase to the backup trip value of 105% and then tripped by BOST action.
 - 5.2.1.3 Turbine Valve Testing the inservice testing of turbine valves shall be as follows:
 - 5.2.1.3.1 Main Stop Valves and Combined Intercept Valves will be tested daily.
 - 5.2.1.3.2 Control Valves and Extraction Nonreturn Valves will be tested weekly.
- 5.2.1.3.3 At least once per week, closure of each valve during test will be verified by direct observation of the valve motion.
- 5.2.1.3.4 All Main Stop Valves, Control Valves, Extraction Nonreturn Valves, and Combined Intercept Valves will be tested under load. Pushbuttons on the EHC test panel permit full stroking of the Main Stop Valves, Control Valves and Combined Intercept Valves. Extraction Nonreturn Valves are tested locally by equalizing air pressure across the air cylinder. Movement of the valve arm is observed upon action of the spring closure mechanism.

5.2.2 The calibration program for the turbine overspeed protection program shall include the following at least once per 18 months or following major maintenance on the turbine generator or the overspeed protection system.

5.2.2.1 Mechanical Overspeed Trip Calibration - the mechanical overspeed trip test is designed to verify calibration of the turbine mechanical overspeed trip system. The turbine speed is increased to the trip setpoint of 109.5% and speed at which the trip occurs is recorded. If the as-found trip value is out of tolerance, the trip setpoint is adjusted and the test is repeated.

5.2.2.2 Backup Overspeed Trip Calibration - the BOST is designed to verify calibration of the electrical Auxiliary Speed Sensor unit. In the NORMAL mode this trip is set at 110% of rated speed and is a backup to the mechanical overspeed trip. In the STANDBY mode this trip is reduced 'to 105% and provides the first line of protection. The actual speed at which the trip occurs is compared to the trip setpoint. If the as-found trip value is out of tolerance, the trip setpoint is adjusted and the test is repeated.

- 5.2.3 Maintenance and Inspection Program.
- 5.2.3.1 The inservice inspection examination of valves important to overspeed protection shall include the following:
- 5.2.3.1.1 All Main Stop, Main Control, Combined Intercept and Extraction Nonreturn valves will be inspected once during the first three years. Inspection of all valves of one type will be conducted if any unusual condition is discovered. Subsequent inspections will be scheduled so that each valve is inspected at 3- to 5-year intervals. The inspections will be conducted for:
 - a. Wear of linkages and stem packings
 - b. Erosion of valve seats and stems
 - c. Deposits on stems and other valve parts which could interfere with valve operation
 - d. Distortions, misalignments
- 5.2.3.2 Tightness tests of the main stop and control valves are performed at least once per 18 months by checking the coastdown characteristics of the turbine from no load with each set of four valves closed alternately. Platforms provided for valve maintenance permit observation of the valve motion.

- 5.2.3.3 The inservice inspection program for the turbine assembly includes the disassembly of the turbine and complete inspection of all normally inaccessible parts, such as couplings, coupling bolts, turbine shafts low-pressure turbine buckets, low-pressure wheels, and high-pressure rotors. During plant shutdown coinciding with the inservice inspection schedule for ASME Section III components, as required by the ASME Boiler and Pressure Vessel Code, Section XI, turbine inspection is done in sections during the refueling outages so that in 10 years total inspection has been completed at least once.
- 5.2.3.3.1 This inspection consists of visual and surface examinations as indicated below:
 - a. Visual examination of all accessible surfaces of rotors and wheels
 - b. Visual and surface examination of all low-pressure buckets
 - c. 100-percent visual examination of couplings and coupling bolts
- 5.2.3.3.2 Inservice inspection of the bores and keyways of the low-pressure turbine discs will be in accordance with the manufacturer's recommendations.
- 6.0 REPORTING
- 6.1 The Main Stop Control, Combined Intercept, and Extraction Nonreturn valves shall be included in the Nuclear Plant Reliability Data System (NPRDS). Deficiencies shall be reported and included in the data bank, and reviewed so that appropriate changes may be made in the Callaway Plant program based on reliability information.
- 7.0 RECORDS
- 7.1 Records for the Turbine Overspeed Protection Reliability Program shall be maintained in accordance with the implementing procedures.

8.0 REVISIONS TO THE TURBINE OVERSPEED PROTECTION RELIABILITY PROGRAM

> Modifications, deviations, and other changes to the Turbine Overspeed Protection Reliability Program as a result of on-going review by Union Electric Company shall be initiated and processed in accordance with Callaway Plant Administrative Procedures, Callaway Plant Technical Specifications and implemented in accordance with the provisions 10CFR50.59.

- 9.0 REFERENCES
- 9.1 Callaway Plant Technical Specifications
- 9.2 APA-ZZ-00101, "Preparation, Review, Approval, and Control of Plant Procedures"
- 9.3 APA-ZZ-00140, "Conduct of Engineering and Safety Evaluations"
- 9.4 Final Safety Analysis Report
- 9.5 GEK-65907 VOL. I
- 9.6 GEK-64907 VOL. II