NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
South Texas, Unit 1	05000 498	1 OF 11

TITLE (4) Technical Specification Required Shutdown due to the Inoperability of an Auxiliary Feedwater Pump

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
02	04	93	93	-007-	00	03	05	93	South Texas, Unit 2	05000 499
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	98	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Jairo Pinzon - Senior Engineer	(512) 972-8027

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
E	BA	TUR	T147	Yes						

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On February 4, 1993, Unit 1 was in Mode 1 at 98% power. At 0937 hours, Unit 1 commenced a plant shutdown and an Unusual Event was declared due to the failure to return the Turbine Driven Auxiliary Feedwater Pump (TDAFWP) 14 to an operable status within the required Technical Specification allowed time. On February 1, 1993, during performance of a surveillance test, TDAFWP 14 tripped on overspeed. This resulted in the pump being declared inoperable and Unit 1 entering a 72 hour action statement. On February 3, 1993, Unit 2 experienced a reactor trip at which time TDAFWP 24 oversped and tripped. Since the 72 hour allowed time was due to expire soon and the cause of the Unit 2 overspeed had not been determined, Unit 1 was shutdown. The cause of the TDAFWP 14 overspeed events was water intrusion into the TDAFWP turbine adversely affecting performance. Corrective actions included extensive testing, analysis, and component examination to determine the causes of overspeed trips on TDAFWP 14 and TDAFWP 24.

REQUIRED NUMBER OF DIGITS/CHARACTERS
FOR EACH BLOCK

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

DESCRIPTION OF EVENT:

Unit 1 Auxiliary Feedwater Pump

On February 4, 1993, Unit 1 was in Mode 1 at 98% power. At 0937 hours, Unit 1 commenced a plant shutdown and an Unusual Event was declared because Turbine Driven Auxiliary Feedwater Pump (TDAFWP) 14 was not returned to an operable status within the required Technical Specification allowed time.

After entry into Mode 3, as the fourth refueling outage was coming to an end, a surveillance was performed on TDAFWP with satisfactory results. Due to a problem encountered with control rod housing leakage, Unit 1 was cooled down for repairs. After the cooldown, the trip/throttle valve (MS-0514), which had been leaking prior to the outage, was disassembled for inspection and possible repair. The inspection revealed that the disc and seat had steam cuts. Repairs could not be effected because no replacement parts could be located. The valve was subsequently reassembled. Unit 1 entered Mode 3 at 0202 hours, on December 26, 1992. At 0102 hours the following morning, TDAFWP 14 oversped and tripped during a Post Maintenance Test (PMT) surveillance run. The operators used guidance provided in the AFW system operating procedure and performed a slow manual start of the pump. A successful surveillance was subsequently performed. During the investigation of this event, this surveillance was determined to be inadequate because of the manual start of the turbine. The pump and valve were declared operable following two more Motor Operated Valve Actuator Test (MOVATS) related starts. An Anticipated Transient Without Scram (ATWS) Mitigation System Actuation Circuitry (AMSAC) test was performed on December 31, 1992, without an overspeed occurrence. The AMSAC test is unlike the usual surveillance in that normally open MS-0143 is closed prior to the test. Since the stroke time of MS-0143 is greater than MS-0514, the result is a slower admission of steam to the TDAFWP than during a normal surveillance start.

DESCRIPTION OF EVENT: (Con't)

The next TDAFWP 14 activity occurred on January 28, 1993, at 0600 hours. A number of activities were performed on TDAFWP 14 (pump and turbine) as part of a planned outage. On the same day, during a PMT surveillance run, TDAFWP 14 tripped on overspeed. On January 29, 1993, an attempt was made to perform a slow manual start of the pump. The turbine again tripped on overspeed.

Troubleshooting activities occurred on January 29, 1993, including contacting the governor vendor. The vendor arrived onsite on January 30, 1993, and determined that the governor valve was not closing completely. This finding corresponded to the symptoms of both the overspeed events and subsequent troubleshooting efforts. It was believed that the governor valve was misadjusted during the activities that took place on January 28, 1993. A number of successful starts were performed on January 30, 1993. At 1742 hours, on January 30, 1993, the surveillance for TDAFWP 14 was performed and successfully completed at 1905 hours. The pump was declared operable at 1908 hours.

On February 1, 1993, a surveillance test was performed at the request of the Unit 1 Operations Manager during which TDAFWP 14 tripped on overspeed. This resulted in the pump being declared inoperable and Unit 1 entering a 72 hour action statement. Extensive troubleshooting and evaluation ensued. On February 3, 1993, Unit 2 experienced a reactor trip during which TDAFWP 24 oversped and tripped (Unit 2 LER 93-004). The occurrence of this event coupled with previous Unit 1 overspeed events, resulted in the decision to shutdown Unit 1.

Unit 2 Auxiliary Feedwater Pump

On January 8, 1993, a successful surveillance on TDAFWP 24 was performed in which the pump started under normal service conditions. On January 23, 1993 Unit 2 experienced a reactor trip. The TDAFWP actuated and performed satisfactorily. Following the trip, operators attempted to secure the TDAFWP by using the control board trip pushbutton (electrical trip). This is not the normal method of closing MOV-0514 to secure the turbine.

DESCRIPTION OF EVENT: (Con't)

Coincident with the trip, a mechanical overspeed indication was received in the control room. Investigation revealed that the mechanical overspeed trip device was actuated due to agitation caused by the electrical trip plunger. No physical overspeed condition actually occurred.

Activities on January 24th and 25th focused on correcting the above situation. On January 24th, several attempts to restart the pump resulted in a mechanical overspeed. The overspeed was believed to be due to moisture build up from closing MOV-0143. The TDAFWP was again started by locally opening MOV-0514. This was performed for water evacuation. The pump was then tripped from the control room. No mechanical overspeed trip annunciator was received and MOV-0514 reset normally. Maintenance troubleshooting discovered the mechanical trip linkage adjustment was too short. The TDAFWP was started locally and, when tripped from the control room, the mechanical overspeed trip device became unlatched. Two additional test runs of the TDAFWP 24 were initiated with no overspeed. On the 25th of January, the surveillance test for TDAFWP 24 was completed satisfactorily and the pump was declared operable.

Engineering contacted the valve manufacturer of MOV-0514 to discuss the situation. The problem with the overspeed linkage mechanism impact clearance was caused by a linkage pin diameter discrepancy wherein the actual pin size was 1/2" versus the 3/8" specified by the vendor. The manufacturer agreed to allow the impact clearance reduction in the linkage provided that the latch disengagement spring tension was increased to 30 lbs.

On January 30, 1993, TDAFWP 24 was again declared inoperable in order to verify the proper overspeed trip arm clearance and to obtain data on spring tension on the overspeed mechanism. Upon completion of two surveillance starts, the pump was declared operable.

DESCRIPTION OF EVENT: (Con't)

A follow up call between Engineering and the valve manufacturer revealed that an impact gap of < 1/8" would be adequate. Engineering reevaluated the situation and decided that, although the short term spring adjustment would provide adequate prevention of unlatching problems, the long term corrective action should include modification of the slot length of the trip linkages on both units.

On February 3, 1993, Unit 2 tripped with an associated AFW actuation. TDAFWP 24 experienced an overspeed trip upon startup associated with the AFW actuation.

Investigation revealed that the above seat drain valve bypass (MS-217) was closed at the time of the overspeed event. Historical computer data was analyzed to determine when the valve position was changed subsequent to valve lineups being performed on April 15, 1992. This analysis determined that the Unit 2 above seat drain bypass had been out of position since a maintenance period between April 28, 1992 and April 29, 1992 allowing only marginal condensate drain flow. The valve stayed in that position, with slight leakage through it until January 24, 1993, when the Head Reactor Plant Operator verified the bypass being closed, causing a further reduction in drain flow. Further investigation of the valve lineup condition in Unit 2 revealed that the operators were not sure what the proper valve position should have been at the time that the overspeed event occurred.

CAUSE OF EVENT:

Unit 1

The cause of the TDAFWP 14 overspeed events was water intrusion into the TDAFWP turbine adversely affecting performance. The specific mechanism that precipitated the overspeed event is not known, however, it is believed that the causes are bounded by the following:

- Leakage through MOV-0514 valve
- Adverse effects of water accumulation in the governor valve
- Adverse effects of water accumulation in the turbine casing
- Coordination of trip/throttle valve stroke time and governor valve response capability.

CAUSE OF EVENT: (Con't)

Unit 2

The cause of the Unit 2 overspeed event was water intrusion into the turbine from the upstream piping. Ineffective removal of condensate from the upstream steam supply piping has been attributed to the inappropriate closing of a steam trap bypass valve. The ineffective removal of condensed steam from the above seat drain of the trip/throttle valve resulted in the presence of water in the steam supply line. The effect of this is a challenge to the capability of the governor control system. The overspeed trip linkage issues did not cause this overspeed trip.

ANALYSIS OF EVENT:

Based on the investigation, the Unit 1 TDAFWP was determined to be inoperable since the end of the Unit 1 fourth refueling outage. Thc Unit 2 TDAFWP was determined to be operable on January 30, 1993 by the successful completion of a monthly inservice test. It is speculated that some time between this date and February 3, 1993, the condensate buildup rendered the Unit 2 TDAFWP incapable of sustaining an automatic start without overspeeding and therefore, the pump was inoperable.

Completion of a plant shutdown required by Technical Specification is reportable pursuant to 10CFR50.73(a)(2)(i)(A). Operation with the TDAFWP inoperable for greater than 72 hours constituted an operation prohibited by Technical Specifications and is reportable pursuant to 10CFR50.73(a)(2)(i)(B).

The Auxiliary Feedwater (AFW) System at the South Texas Project (STP) is an Engineered Safety Feature (ESF). Its purpose is to provide cooling flow to each of the four steam generators immediately following a transient or an accident to remove decay heat. The system is comprised of four mechanically and electrically independent trains, each providing flow to a dedicated steam generator, three of which include a motor driven pump (MDP) and the fourth a turbine driven pump (TDP). This concept provides diversity and, therefore, reduces the potential for common mode failure. The turbine driven pump also provides cooling in the event of a station blackout (SBO) when in modes 1,2 or 3.

ANALYSIS OF EVENT: (Con't)

An important aspect of the subject events with regard to safety impact is the fact that overspeed conditions did not adversely affect the functionality of the TDAFWP. The conditions experienced by each TDAFWP (one on each STP unit) would adversely impact the operability of that pump in that there is no assurance that the pump would start and run as the result of an automatic actuation. However, the problems encountered did not preclude the pump from being started and run as the result of reasonable operator action and therefore fulfilling its safety function with a high degree of confidence.

The safety analysis assumes that for design basis accidents (Chapter 15 of the STP Updated Final Safety Analysis Report (UFSAR)), a limiting single failure will occur. For accidents that require the operation of the AFW system, the limiting single failure is in the ESF actuation logic that initiates auxiliary feedwater flow. The UFSAR Section 15 Safety Analysis assumes that two AFW pumps operate. The configuration of AFW at STP has ESF Actuation Train A starting AFW trains 1 and 4 (train 4 includes the TDAFWP), ESF Train B starting AFW train 2, and ESF Train C starting AFW train 3. With AFW train 4 out of service, a minimum of two AFW trains would still be operable after any single failure. Therefore, the results of the UFSAR Section 15 safety analysis are not impacted with AFW train 4 not available.

The AFW system is also used to mitigate the Anticipated Transient Without Scram (ATWS) initiating event. The Solid State Protection System (SSPS) and Engineered Safety Features Actuation System (ESFAS) serve to provide actuation signals to the AFW system should an ATWS initiating event occur. Additionally, both operator action and the ATWS Mitigating System Actuation Circuitry (AMSAC) serve as recovery and backup sources of AFW system actuation signals. The STP Level 2 Probabilistic Safety Assessment ("L2 PSA") does not take credit for AMSAC and shows that the frequency of an ATWS event at STP is insignificant. In the very unlikely event of an ATWS, loss of the TDAFWP due to an overspeed trip would still leave three pumps to mitigate the event.

ANALYSIS OF EVENT: (Con't)

Cold shutdown capability of STP has been evaluated to demonstrate that the units can achieve cold shutdown conditions following a Safe Shutdown Earthquake (SSE) assuming a single failure and the loss of offsite power (LOOP). The AFW system is an integral part of that capability. Assuming that the TDAFWP is lost due to an overspeed condition and an additional train is lost due to a single failure then two trains of AFW remain to ensure that cold shutdown is reached. Two trains of AFW will provide decay heat removal while assuring that the pressurizer does not go water-solid, and one train of AFW delivered to one steam generator will assure decay heat removal but the pressurizer may go water solid. Also note that in the event of a fire affecting a single safety train, STP has single train shutdown capability, thus providing redundant shutdown capability of the remaining two trains.

The most important function considered for the TDAFWP is its role in mitigating the Station Black Out (SBO) event. The SBO event includes the provision for an Alternate Alternating Current (AAC) source. This source is the Train B Standby Diesel Generator (SDG). This emergency AC source provides power to it's associated train components as well as providing backfeed capability to either the Train A or C centrifugal charging pump (CCP) and Class 1E battery charger. As a result, the SBO analysis assumes that two AFW trains, Train B and Train D (the TDAFWP) will be available to mitigate the blackout with no cross-connecting (i.e., no operator action) required. If it is assumed that the TDAFWP is not available, then the one train of AFW is still adequate in terms of cooling flow. However, to ensure that the heat transfer rate from the Reactor Coolant System (RCS) is sufficient, it is necessary to cross-connect and provide flow to an additional steam generator. This will require operator action. Since the time frames involved are relatively long (~47 minutes, steam generator dry out time), the operator action to cross-connect one or more steam generators can be performed before the affected steam generator becomes dry. It can also be expected that, given the failure modes se' , with the TDAFWP, there is a high probability that the pump can be returned to service following an overspeed trip, as was demonstrated by the subject events. Note that the L2 PSA, which the NRC has reviewed and has accepted for safety evaluations (e.g., technical specification evaluations, waivers of compliance, etc.), assumes that one train of AFW to one steam generator, as discussed above, will provide adequate decay heat removal but not necessarily prevent the pressurizer from going water-solid.

CORRECTIVE ACTIONS:

The following actions have been taken or will be taken to address the Unit 1 and Unit 2 events and generic implications.

1. Both Units' trip/throttle valves and governors were sent to representative vendors for complete refurbishment and testing. The gearing arrangement of the trip/throttle valve was modified to ensure slower stroke time thus enabling a more positive governor response. Additionally, the governor valves were reworked. The governor valve stems were replaced.

2. A review of the generic implications associated with the blockage of the Unit 1 TDAFWP exhaust drain has been conducted. Both units exhaust drains have been inspected for the presence of foreign material. Other safety related equipment in the area was inspected for possible foreign material intrusion, with no adverse findings. A sample of the foreign material was analyzed and determined to be the result of sand blasting operations. Additionally, the Unit 1 orificed cap was removed from the turbine exhaust drain line. (Unit 2 did not have an orificed cap installed).

3. A modification to the TDAFWP drain system was implemented to remove the steam traps in the steam line drain system, replacing it with a spool piece.

4. The trip/throttle valve high pressure stem leakoff was separated from the turbine casing and rerouted to the sump to prevent possible steam intrusion into the turbine casing.

CORRECTIVE ACTIONS: (Con't)

5. Operating procedures identified as deficient during the review have been changed to reflect present system design and operability considerations. Operator logs were also changed to monitor the above seat drains. Deficient field labeling was removed.

6. Enhanced testing will be conducted prior to declaring the TDAFWP operable. Testing will include:

   - Verification of the drain system operation
   - Verification of the proper operation of the trip/throttle valve
   - Verification of governor valve operation
   - Verification of the trip /throttle valve linkage, overspeed linkage and governor valve interface.

   This testing has been completed in Unit 2 and will be completed in Unit 1 prior to Unit 1 entering Mode 2.

7. Maintenance training and procedures will be reviewed for the inclusion of vendor requirements and other enhancements. This review will be completed and a Plan of Action developed by April 15, 1993. HL&P will use the equipment vendors for maintenance of the TDAFWP trip/throttle valves, governor valves and associated control linkages until appropriate procedure enhancements and training is conducted.

8. HL&P will develop a program to monitor MOV-0514 leakage. This program will be developed by June 30, 1993.

9. An augmented surveillance testing program has been developed to ensure that the corrective actions have in fact addressed the overspeed causes.

10. HL&P has performed a verification of system lineups and adequate drainage systems. This verification has been performed to ensure that the steam line supply to the TDAFWP is optimized in terms of condensate removal. Based on this verification HL&P will evaluate additional design changes by April 15, 1993.

CORRECTIVE ACTIONS: (Con't)

11. HL&P will perform an evaluation to determine the cause of the pitting of the governor valve stem. Corrective actions will be developed as necessary. This evaluation will be completed by April 30, 1993.

Although not a specific corrective action, the following actions were taken by HL&P with respect to this event

1. Quality Assurance performed an in depth review of AFW procedure, work documentation, preventive maintenance, and industry events to determine the adequacy of the HL&P program with respect to AFW system operation and maintenance.

2. The Nuclear Safety Review Board (NSRB) reviewed the investigation to determine the adequacy of the root cause findings.

3. The Plant Operations Review Committee (PORC) reviewed and approved the enhanced testing procedure.

4. Sargeant & Lundy was retained to perform an independent review of the root causes and proposed corrective actions developed by HL&P. Their findings were consistent with HL&P's.

ADDITIONAL INFORMATION:

In the past two years there have been no similar events regarding a Technical Specification required shutdown due to the inoperability of the TDAFWP. Unit 2 LER 93-004 documents a reactor trip in which the Unit 2 TDAFWP also tripped on overspeed.