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John A. Scalice
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MAY 27 1996

U.S. Nuclear Regulatory Commission
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Gentlemen:

In the Matter of) Docket No. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) - UNIT 1 - NRC INSPECTION REPORT 50-390/96-05 - REPLY TO NRC REQUEST FOR INFORMATION

The purpose of this letter is to provide TVA's response to the subject NRC Inspection Report, provided by NRC's letter dated April 25, 1996. The Staff's report documents the results of Region II's Operational Readiness Assessment Team (ORAT) inspection, conducted from March 18-22, 1996, for WBN Unit 1. NRC's letter requested that TVA respond to three areas of concern with an assessment of each concern and their collective impact: (1) TVA's investigation of the March 18, 1996, turbine trip event was hampered by cumbersome data gathering techniques; (2) the occurrence of secondary plant failures during the March 18 event indicates a potential negative trend in secondary plant equipment performance; and (3) it was not clear that TVA had effectively implemented the operator workaround definition. In the Staff's April 25, 1996 letter, the NRC noted their concern that collectively and individually, these three issues might complicate operator and plant response during future abnormal conditions.

The following provides TVA's collective assessment of the concerns expressed by the NRC Staff. TVA's evaluation of the individual NRC concerns is provided in Enclosure 1.

TVA has conducted a number of thorough assessments and evaluations of plant issues identified during the Power Ascension Test Program which began in November 1995. These efforts included: (1) analyses of each of the manual and automatic turbine/reactor trips and forced shutdowns; (2) evaluation of the accompanying responses of plant equipment and personnel; and (3) development of corrective actions. TVA's analyses of most of these issues has been detailed in Licensee Event Reports (LERs), in addition to internal investigation reports made available to NRC onsite inspectors. TVA presented the results of the assessments in the TVA/NRC Management Meeting held at the WBN Energy Connection Center on May 10, 1996.

As discussed with the Staff on May 10, 1996, TVA concluded that isolated past instances of inadequate design review, in combination with examples of deficient vendor designs and unsatisfactory human performance, have been responsible for most of WBN's equipment performance problems and operator challenges during the Power Ascension Test Program. Equipment failure has not been a significant contributor to these events and negative equipment trends were not identified for the secondary or primary plant. However, examples of unsatisfactory personnel performance were observed, especially in the area of plant status control and surveillance testing. In addition to the specific corrective measures for these items (addressed in LERs and WBN corrective action documents), increased attention has been focused on these areas by line management as well as Nuclear Assurance.

In some instances, operator workarounds established for secondary plant equipment complicated the response of the plant and operators to the initial transient. Such was the case for the existing design for draining the Number 2 feedwater heaters, which resulted in a loss of normal feedwater on several occasions. Although the event investigation process readily identified the root cause, initial corrective actions focused on improving the compensatory procedural measures with a longer term design change resolution, resulting in an operator workaround. Likewise, the event investigation process was effective in identifying design weaknesses for the main

feedwater pump turbine (MFWPT) condenser vent, however, the long term proposed corrective action (rerouting of the vacuum line directly to the main condenser) was not classified as a workaround. Implementation schedules then contributed to a second MFPT condenser event.

These and other secondary plant performance issues are isolated examples of design errors (inadequate design review and vendor design deficiencies), which predominantly occurred during the WBN construction stage, prior to beginning the test program. Personnel errors were also involved in many of these events, and remain as an area requiring additional management attention. Most of the issues identified required the secondary plant to be fully operational and in service to detect the deficiency or observe the unexpected transient. Although the problems identified were not directly associated with a specific test, TVA considers the thorough and deliberate conduct of our RG-1.68 Power Ascension Test Program to have been a strength in identifying and resolving equipment inadequacies.

In summary, TVA believes the reasons for both the primary and secondary equipment problems and unplanned plant transients which have occurred since WBN Unit 1 fuel load are well understood and have been or are being corrected. Improvements in human performance, with emphasis in areas such as plant status control and surveillance testing, are necessary and are receiving full management attention. The identification and minimization of operator workarounds to reduce challenges to plant and operator response has been effective and receives high plant visibility and monitoring through the Plan of the Day (POD) meetings and the POD Report. TVA considers that the current workaround definition can be applied consistently and practically for emerging issues. Lastly, the overall event investigation process has been improved in several areas, with additional enhancements expected. Together, these corrective measures and other initiatives are expected to reduce challenges to the response of plant equipment and operators to potential transients. Line management and Nuclear Assurance will continue to monitor performance in these areas until performance improves and meets management expectations.

Enclosure 2 lists the commitments made in this submittal.

If there are any questions on this response, please contact P. L. Pace at (423) 365-1824.

Sincerely,

J. A. Scalice

Enclosures

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ENCLOSURE 1
WATTS BAR NUCLEAR PLANT (WBN) - UNIT 1
NRC INSPECTION REPORT 50-390/96-05, APRIL 25, 1996
REPLY TO NRC REQUEST FOR INFORMATION

NRC Concern 1:

Event investigation was hampered by cumbersome data gathering techniques. Several of the data recording systems were not synchronized, causing difficulty chronologically reconstructing a sequence of events.

TVA Response 1:

TVA concurs with the Staff's observations. To improve reconstruction of event sequences, clock times for the Ronan Alarm System, ERFDS (Emergency Response Facility Data System), the P2500 computer, and the Unit 1 main control room clock were manually synchronized following the March 18, 1996 event. To account for instrument drift, recent practice involves making informal, routine checks and adjustments if necessary, of the clock times for ERFDS and the P2500 computer. TVA is currently evaluating other potential long term design solutions which would eliminate the need for periodic adjustments of this equipment. TVA has resolved the incorrect ERFDS indication for pressurizer PORV 1-PCV-68-340 discussed in the Staff's Inspection Report. In addition, TVA plans to validate key ERFDS input points by June 30, 1996.

A number of other initiatives were taken and have been effective in improving WBN's performance during formal investigations of reactor and turbine trips. Improvements were made in the areas of Team Leadership and Composition, Facilities and Equipment, and in Event Investigative Processes.

First, the event response team leadership now consists of a WBN upper manager serving as the Event Manager responsible for providing overall guidance, decision making, and interface with senior WBN management. The Event Manager relieves the Team Leader of many extraneous demands and allows him to direct and focus on the investigation. The Event Response team roster corresponds to the on-duty emergency response teams and is published each day in the POD report.

Second, improvements in the Technical Support Center (TSC) facilities and equipment include ERFDS enhancements, which provide reactor trip group displays (speeds data acquisition), additional computer equipment/software, placement of action item status boards, and installing a dedicated reference locker containing response supplies.

Third, Position Response Books have been established and are maintained in the TSC. These books provide information concerning the duties and responsibilities of various TSC event response positions, in addition to references and guidelines for completion of the event critique report. Most of these enhancements were implemented during recent event investigations. Additional improvements may be implemented as TVA continues to monitor and solicit feedback on the Event Response process.

NRC Concern 2:

A number of secondary plant failures occurred during the loss of load event that indicate a potential negative trend in secondary plant equipment performance. Several component failures complicated operator and plant response to the loss of load.

TVA Response 2:

TVA's analysis of the March 18, 1996, loss of load event is provided in our event critique report dated March 25, 1996. This report was made available to NRC onsite personnel. The event involved a loss of load from 456 MWe to near zero, followed by a manual turbine trip. TVA's initial investigation of this event was unable to positively confirm the root cause. Therefore, a specific plan was developed to install additional data acquisition instrumentation to provide needed data for better analysis of plant responses should the condition re-emerge. Subsequently, after a similar transient required a manual turbine trip on April 16, 1996, TVA identified the root cause for both events as the AMSAC (anticipated transient without scram mitigation system actuation circuitry) auto-test circuit. Voltages applied to actuation relay contacts during auto-testing inappropriately resulted in partial actuation of the turbine overspeed protection (OPC) solenoid. This failure was the result of a vendor interface design error. TVA's detailed analysis of the April 16, 1996, trip was provided to the Staff under LER 50-390/96014.

As noted in the subject NRC inspection report (390/96-05), several secondary plant equipment problems either contributed to or were observed during this event. Each of these have been evaluated and corrected. In addition to the AMSAC test circuit, other problems included improperly set bistables for the steam dump valves, opening

of the steam generator atmospheric dump valves (ADVs) and up to four safety valves, and brief opening of both pressurizer power operated relief valves (PORVs). Each of these issues was the result of an isolated failure or an expected response to the transient caused by improper operator action in closing the main steam dump valves (discussed below). The investigation team found no evidence of negative trends in overall equipment performance.

In particular, the investigation team found that the steam dump bistables had incorrect setpoint values due to a procedural error. This problem alone did complicate the operator's and the plant's response to the loss of load event by effecting a nearly simultaneous opening of all steam dump valves. This unusual rapid opening of all steam dump valves occurred early in the event (prior to turbine trip) and was suspected by Operations personnel to be an inadvertent actuation due to a perceived failure of main turbine impulse pressure instrumentation. In response, operators removed the steam dump valves from service. Within a few seconds after the steam dump valves were closed, main steam pressure increased to the point that the SG atmospheric dump valves opened as designed, and up to four main steam safety valves opened and then closed, followed by high pressurizer pressure and opening of both pressurizer PORVs for about three seconds. These were expected automatic plant responses in view of the prior manual isolation of the steam dump valves. Upon recognizing their inappropriate action (about one minute later), Operations returned the steam dump valves to service. Immediate lessons learned training was provided for Operations shift crews on this event prior to their assuming shift. In addition, the scenario has been included in the Operations Requalification Training Program. The plant responses and conditions for this event were consistent with and bounded by the Loss of Load/Turbine Trip Event discussed in the WBN Final Safety Analysis Report.

As a result of this event and several others which occurred during the Power Ascension Test Program, TVA analyzed plant performance, including secondary plant issues, to determine if any programmatic problems contributed to the events. The results of these reviews were reported in the TVA/NRC Management Meeting held at the WBN Energy Connection Center on May 10, 1996. These reviews found that overall, negative trends have not been observed; however, areas of concern were identified. Design issues associated with the original secondary plant design were the primary concern as well as a need to improve personnel performance. Equipment failure was not identified as a significant contributor. Excerpts from TVA's May 10, 1996, meeting presentation summarize our analyses in this area (Attachment 1).

NRC Concern 3:

Although the operator workaround definition is new, it was not clear that TVA had effectively implemented the definition. Several operator manipulations were noted that do require immediate operator attention during response to abnormal conditions that were not considered workarounds.

TVA Response 3:

WBN has developed and implemented an effective Operations Workaround program which strives to minimize and expeditiously resolve the use of workarounds. WBN defines an Operator workaround as follows:

> A long-term equipment problem or deficiency of a maintenance or engineering nature which requires compensatory actions to be taken by Operations.

Two priorities are assigned - Priority 1: Operator action must be taken during response to an accident or transient, and Priority 2: Operator action must be taken during normal operation as a compensatory measure. TVA considers the above definition can be practically and consistently applied.

WBN management's increased emphasis on resolving workarounds is accomplished by listing each issue in the POD on Wednesdays, including a brief description, the department responsible for resolution, and issue status. The responsible manager is available in the morning POD meeting to address questions on resolution progress as well as to identify problems, schedule concerns, material and other design restraints, etc., with department representatives in the POD meeting.

The WBN workaround list is developed and maintained based on periodic reviews and assessments of maintenance issues, caution orders, Operations' concerns, disabled alarms, equipment deficiencies, and discussions with operators. The individual and aggregate impact of identified workarounds is considered to ensure that appropriate controls and compensatory measures are in place.

The increased management focus on this area is expected to provide reasonable assurance that potential workarounds are properly classified, tracked, and resolved in a timely manner. As of May 23, 1996, WBN was tracking eight workarounds (one Priority 1, and seven Priority 2). These issues either have identified solutions with a schedule for resolution or the item is under evaluation.

The status for the three examples of operator workarounds discussed in the NRC inspection report is as follows:

(1) Feedwater long cycle pressure regulating valve (1-PCV-3-40A)- Resolved. Controller replaced.

(2) Automatic TDAFW steam supply swap-over - Design change issued to revise circuit; currently scheduled for WBN mid-cycle outage.

(3) Number 2 feedwater heater isolation (no bypass) - Design issued and partially installed; completion currently scheduled for early August 1996.

PLANT EVENTS

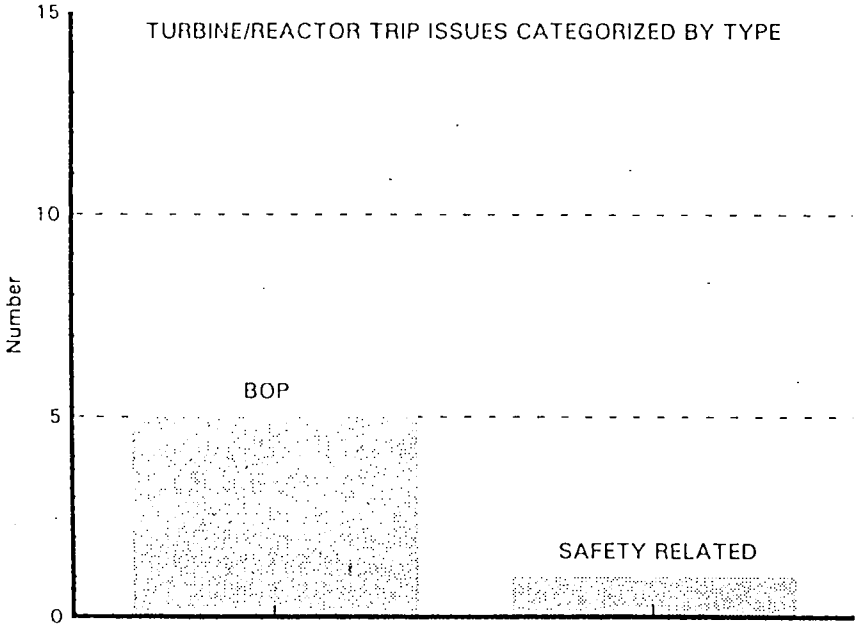
DATE/ POWER	EVENT	ISSUE	CAUSE			CORRECTIVE ACTION	STATUS
			DESIGN	PERS	EQUIP		
2/10/96 & 2/17/96 15%	AUTOMATIC TURBINE TRIP DUE TO INADVERTENT ACTUATION OF TURBINE TRIP RELAY (MEGAWATT TRANSDUCER)	MEGAWATT TRANSDUCER (INITIAL ASSUMPTION WAS DEBRIS IN TURBINE AUTO-STOP OIL)	X			INTERIM--DISCONNECTED WATT TRANSDUCER LONG-TERM MODIFIED TURBINE TRIP LOGIC	COMPLETE COMPLETE
2/17/96 & 2/19/96 15%	MANUAL TURBINE SHUTDOWN DUE TO PROBLEMS WITH HOTWELL LEVEL CONTROL SYSTEM INADVERTENT SWAPOVER OF TDAFW PUMP SUCTION TO ERCW	INAPPROPRIATE CONTROLLER LOCATION RESULTING IN LOSS OF NORMAL FEEDWATER. LOW FLOW MDAFW PUMP PRESSURE PULSATIONS	X X			MODIFIED INSTRUMENT TAPS PROVIDED INDEPENDENT LEVEL INDICATION INTERIM--USE OF MDAFW SWITCHES TO SWAP BOTH MD AND TD TO ERCW SUPPLY LONG-TERM--ADD INCREASED RECIRC LINE TO MDAFW	COMPLETE COMPLETE COMPLETE NEAR-TERM
3/13/96 49%	MANUAL TURBINE TRIP /DUE TO LOSS OF CONDENSER VACUUM FOLLOWED BY MANUAL REACTOR TRIP DUE TO LOSS OF NORMAL FEEDWATER	PROCEDURE ERROR IN ISOLATING COOLING WATER TO MAIN FEEDWATER PUMP TURBINE CONDENSER (1B) RESULTS IN STEAM BINDING OF MAIN CONDENSER VACUUM PUMPS. NO DIRECT CONNECTION OF MFWPT CONDENSER TO MAIN CONDENSER TO MAINTAIN VACUUM AND CONDENSE STEAM. AUTOMATIC ISOLATION OF FEEDWATER HEATER STRINGS ON HIGH LEVEL IN #2 FW HEATER.	 X X	X		INTERIM - THROTTLED MANUAL VALUES BETWEEN MFW PUMP CONDENSER AND VACUUM HARDWARE LONG-TERM - ADDED VACUUM BYPASS BETWEEN MFW PUMP CONDENSER AND MAIN CONDENSER REVISED TURBINE TRIP PROCEDURE (AOI-17)	COMPLETE COMPLETE COMPLETE

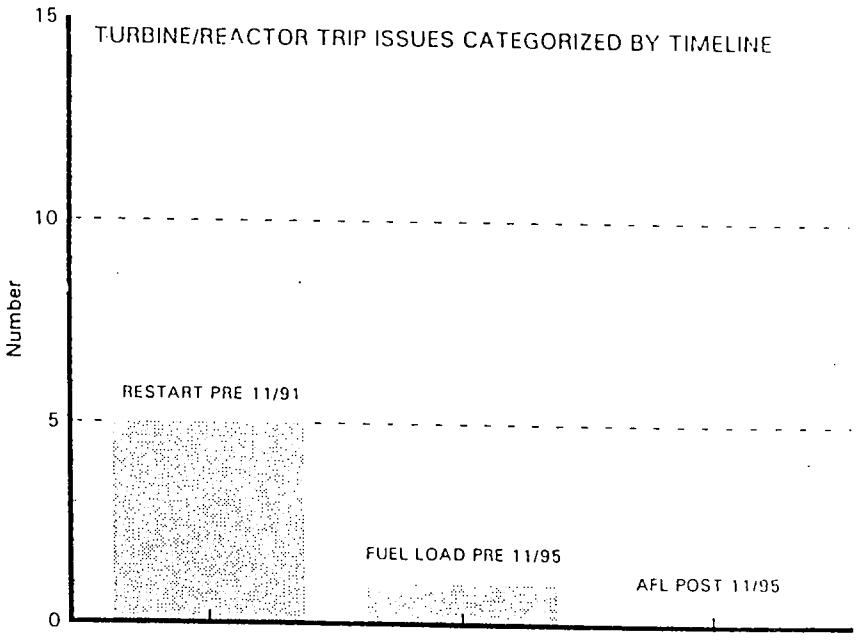
PLANT EVENTS (CONT'D)

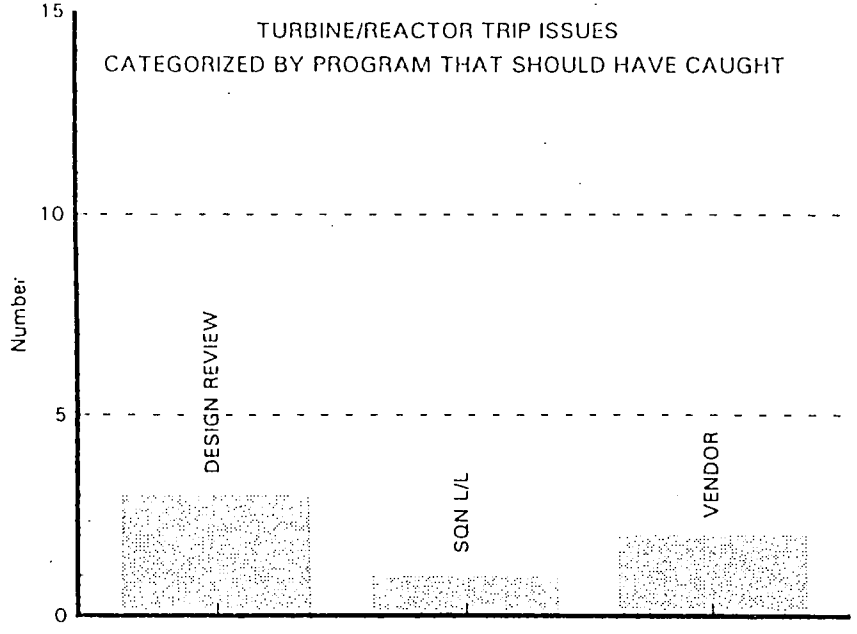
DATE/ POWER	EVENT	ISSUE	CAUSE DESIGN	CAUSE PERS	CAUSE EQUIP	CORRECTIVE ACTION	STATUS
3/27/96 45%	MANUAL TURBINE TRIP DUE TO TRIP OF RCP NO. 3 DURING XFER FROM START BUS TO NORMAL BUS	PRESSURE PERMISSIVE ON OIL-LIFT PUMP DID NOT MAKEUP DUE TO DEFECTIVE RELAY			X	RELAY REPLACED	COMPLETE
	SECONDARY PLANT TRANSIENT REQUIRED AFW START	LOSS OF FLOW DUE TO HEATER STRING ISOLATIONS ON NO. 2 FW HEATER HIGH LEVELS	X			ADDING #2 FEEDWATER HEATER BYPASS TO MAIN CONDENSER	MID-CYCLE
4/1/96 12%	TURBINE TRIP DUE TO EXCESSIVE GENERATOR EXCITATION VOLTAGE	MISMATCH BETWEEN ACTUAL AND INDICATED VOLTAGE DUE TO STUCK INDICATOR. LACK OF QUESTIONING ATTITUDE		X		OPERATOR RETRAINED	COMPLETE
3/18/96 @ 49% AND 4/16/96 @ 84%	MANUAL TURBINE TRIP DUE TO SPURIOUS CLOSURE AT AMSAC ACTUATION RELAYS	AMSAC ACTUATION RELAY	X			AUTO TEST FUNCTION FOR AMSAC ACTUATION RELAY REMOVED	COMPLETE
4/28/96 81%	TURBINE RUNBACK FOLLOWED BY TURBINE AND REACTOR TRIP DUE TO PLANNED TRIP OF MAIN FEEDWATER PUMP	RUNBACK CAUSED BY MISUNDERSTANDING RUNBACK RESET POINT		X		PROCEDURES AND TRAINING REVISED	COMPLETE
		PROCEDURE TO DRAIN FROM ABOVE STOP VALVE SEATS TO PUMP TURBINE CONDENSER EXCEEDED BYPASS COOLING CAPABILITY RESULTING IN TRIP OF OPPOSITE PUMP		X		TDMFP PROCEDURE REVISED	COMPLETE
						MODIFICATION TO CONNECT PUMP CONDENSER TO MAIN CONDENSER	COMPLETE
		TOTAL	7	4	1		

DESIGN RELATED EVENTS

ITEM	DESCRIPTION	EVENT	ISSUE	CATEGORIES							
				BOP	SAFETY RELATED	DATE OF DESIGN			VENDOR	DCN	CAUSE
						PRE 11/91	11/91 -- 11/95	POST 11/95			
1	AUTOMATIC TURBINE TRIP DUE TO INADVERTENT ACTUATION OF TURBINE TRIP RELAY (MEGAWATT TRANSDUCER)	2/10/96 II-W-96-004 2/17/96 II-W-96-004	INADVERTENT ACTUATION OF TURBINE TRIP RELAY	✓			✓			✓	INCOMPLETE DESIGN REVIEW.
2	MANUAL TURBINE SHUTDOWN DUE TO FAILURE OF HOTWELL LEVEL CONTROL SYSTEM.	2/17/96 II-W-96-004 2/19/96 II-W-96-006	HOTWELL LEVEL CONTROL SYSTEM	✓		✓			✓	✓	VENDOR DESIGN ERROR
3	INADVERTENT SWAP-OVER OF TDAFW PUMP SUCTION TO ERCW	2/19/96 II-W-96-006	LOW PUMP DISCHARGE SETPOINT		✓	✓			✓		INCOMPLETE DESIGN REVIEW.
4	MANUAL TURBINE TRIP DUE TO LOSS OF CONDENSER VACUUM.	3/13/96 WBPER960112	LOSS OF NORMAL FEEDWATER	✓		✓					SQN LESSON LEARNED NOT PICKED UP.
5	MANUAL REACTOR TRIP DUE TO LOSS OF NORMAL FEEDWATER.	3/27/96	LOSS OF NORMAL FEEDWATER	✓		✓					INCOMPLETE DESIGN REVIEW.
6	MANUAL TURBINE TRIP DUE TO SPURIOUS CLOSURE OF AMSAC ACTUATION RELAYS.	3/18/96 WBPER960129 4/16/96 WBPER960287	AMSAC ACTUATION RELAY	✓		✓			✓		VENDOR DESIGN ERROR


TURBINE/REACTOR TRIP ISSUES CATEGORIZED BY TYPE
15
10
5
0
Number
BOP
SAFETY RELATED


TURBINE/REACTOR TRIP ISSUES CATEGORIZED BY TIMELINE
15
10
5
0
Number
RESTART PRE 11/91
FUEL LOAD PRE 11/95
AFL POST 11/95


TURBINE/REACTOR TRIP ISSUES
CATEGORIZED BY PROGRAM THAT SHOULD HAVE CAUGHT
15
10
5
0
Number
DESIGN REVIEW
SQN L/L
VENDOR

ATTACHMENT

ENCLOSURE 2
LISTS OF COMMITMENTS

TVA plans to validate key ERFDS input points by June 30, 1996.