

OCT 5 1989

In Reply Refer To:
Dockets: 50-498
50-499

Houston Lighting & Power Company
ATTN: G. E. Vaughn, Group Vice
President, Nuclear
P.O. Box 289
Wadsworth, Texas 77483

Gentlemen:

This refers to the meeting conducted at Houston Lighting & Power Company's request in the Region IV office on October 3, 1989. This meeting related to activities authorized by NRC License Nos. NPF-76 and NPF-80 for South Texas Project, Units 1 and 2. The meeting was attended by those listed on the attached Attendance List.

The subjects discussed at this meeting are described in the enclosed Meeting Summary.

It is our opinion that this meeting was beneficial and has provided a better understanding of Houston Lighting & Power Company's trip reduction plans and accomplishments at STP.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the NRC's Public Document Room.

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

James L. Milhoan, Director
Division of Reactor Projects

Enclosure:
Meeting Summary w/attachments

cc: (see next page)

RIV:C:DRP/D
EJHoller;df
10/5/89

D:DRP 10/5/89
JLM:Jhoan
10/5/89

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PDR ADOCK 05000498
P PDC

IE45
11

Houston Lighting & Power Company

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cc w/ enclosure:

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Houston Lighting & Power Company

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Houston Lighting & Power Company

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bcc to DMB (IE45)

bcc distrib. by RIV:

DRP

DRS

RPB-DRSS

RIV File

RSTS Operator

G. Dick, NRR Project Manager (MS: 13-D-18)

Section Chief (DRP/D)

MIS System

Lisa Shea, RM/ALF

R. Bachmann, OGC

Project Engineer (DRP/D)

MEETING SUMMARY

Licensee: Houston Lighting & Power Company (HL&P)
Facility: South Texas Project (STP)
License Nos.: NPF-76 and NPF-80
Docket Nos.: 50-498 and 50-499
Subject: TRIP REDUCTION REVIEW

On October 3, 1989, representatives of HL&P met with Region IV personnel in Arlington, Texas, to discuss HL&P plans and accomplishments regarding trip reduction at STP. The meeting was held at the request of HL&P. The attendance list and licensee handout are attached to this summary.

Attachments:

1. Attendance List
2. Licensee Handout (NRC distribution only)

ATTENDANCE LIST

Attendance at the October 3, 1989, meeting between HL&P and NRC at Arlington, Texas:

HL&P

R. W. Chewning, Vice President, Nuclear Operations
W. H. Kinsey, Plant Manager, South Texas Project
M. A. McBurnett, Licensing Manager
M. R. Wisenburg, General Manager, Nuclear Safety Review Board

NRC

J. M. Montgomery, Acting Regional Administrator
J. L. Milhoan, Director, Division of Reactor Projects (DRP)
R. F. Burnett, Acting Deputy Regional Administrator
L. J. Callan, Director, Division of Reactor Safety (DRS)
T. P. Gwynn, Deputy Director, DRP
J. P. Jaudon, Deputy Director, DRS
G. F. Dick, Senior Project Manager, Office of Nuclear Reactor Regulation
E. J. Holler, Chief, Project Section D, DRP
D. M. Hunnicutt, Senior Project Engineer, DRP



TRIP REDUCTION REVIEW
OCTOBER 3, 1989

TRIP REDUCTION REVIEW

AGENDA

- o INTRODUCTION
 - R.W. CHEWNING
- o STPEGS OPERATING EXPERIENCE
 - M.R. WISENBURG
- o TRIP REDUCTION REVIEW
 - W.H. KINSEY
- o NSRB REVIEW
 - M.R. WISENBURG
- o CLOSING
 - R.W. CHEWNING

STPEGS OPERATING EXPERIENCE

STPEGS

UNIT 2 OPERATING EXPERIENCE

5 REACTOR TRIPS IN LAST 45 DAYS

9 REACTOR TRIPS SINCE INITIAL CRITICALITY
(6MOS) AS COMPARED WITH UNIT 1 WHICH HAS
HAD 8 REACTOR TRIPS DURING ENTIRE FIRST
CYCLE (18 MONTHS)

UNPLANNED REACTOR TRIPS

per 1000 critical hours

	1987	1988	STPEGS		NEW @ UNITS
			UNIT 1	UNIT 2	
OVERALL INDUSTRY	0.71	0.43			
NEW UNITS	1.96	0.80	0.86	2.44	0.94
AUTOMATIC	1.46	0.63	0.75	2.17	
MANUAL	0.50	0.17	0.11	0.27	
MATURE UNITS	0.52	0.39			
AUTOMATIC	0.46	0.33			
MANUAL	0.06	0.06			

STPEGS UNIT 1 REACTOR TRIPS

TRIP # LER	DATE	INITIATING EVENT	INITIATING EVENT CATEGORY					CAUSAL FACTORS
			EQUIPMENT FAILURES	HUMAN PERFORMANCE	MAINTENANCE	LOOSE CONNECTIONS	NFT DESIGN	
1-001 88-026	2/28/88	EXCESSIVE COOLDOWN					X	DESIGN LTA
1-002 88-026	3/30/88	PARTIAL LOOP WHILE TROUBLESHOOTING GENERATOR RELAYING		X				WORK CONTROL LTA
1-003 88-045	7/19/88	GDPS TROUBLESHOOTING		X				LACK OF ATTENTION
1-004 88-048	8/16/88	TURBINE TRIP FROM LOSS OF STATOR COOLING WATER	X			X	X	CHECK VALVE FAILURE
1-005 88-049	8/26/88	TURBINE TRIP FROM LOSS OF STATOR COOLING WATER	X			X	X	DEFECTIVE FUSE BLOCK
1-006 89-001	1/3/89	TURBINE CONTROLLER FAILURE	X			X		DEFECTIVE WIRE CRIMP
1-007 89-005	1/20/89	MAIN GENERATOR FIRE	X			X		LOOSE TERMINATION
1-008 89-015	7/4/89	FAILED RELAY IN GENERATOR BREAKER CONTROL CIRCUIT	X					VENDOR SUPPLIED INCORRECT RELAY

NFT - NON FAULT TOLERANT

LTA - LESS THAN ADEQUATE

TRR6

STPEGS UNIT 2 REACTOR TRIPS

TRIP # LER	DATE	INITIATING EVENT	INITIATING EVENT CATEGORY					CAUSAL FACTORS
			EQUIPMENT FAILURES	HUMAN PERFORMANCE	MAINTENANCE	LOOSE CONNECTIONS	NFT DESIGN	
2-001 89-9	4/15/89	INCORRECT GENERATOR RELAYING WIRING			X			IMPROPER INSTALLATION
2-002 89-13	4/15/89	ACTION OF REACTOR TRIP BREAKER	X					NONE IDENTIFIED
2-003 89-15	6/2/89	TURBINE TRIP DUE TO LIMIT SWITCH FAILURE	X					DEFECTIVE LIMIT SWITCH
2-004 89-17	7/13/89	MAIN TRANSFORMER FAILURE	X					PHASE A BUSHING FAILED
2-005 89-19	8/23/89	FWIV CLOSED DURING TESTING	X					BENT LIMIT SWITCH ARM
2-006 89-20	8/29/89	SGFP OVERSPEED	X				X	INVERTER CIRCUIT FAILURE
2-007 89-21	9/5/89	SGFP TROUBLESHOOTING	X			X		DEFECTIVE CONNECTOR
2-008	9/19/89	CTAT TURBINE RUNBACK			X			CALIBRATION LIA
2-009	9/22/89	TURBINE TRIP	X				X	CAPACITOR FAILED IN INVERTER

NFT - NON FAULT TOLERANT

LIA - LESS THAN ADEQUATE

TRR7

STPEGS
TRIP REDUCTION REVIEW

TRIP REDUCTION REVIEW

PURPOSE

- o TO DETERMINE THE CAUSE OF THE HIGH NUMBER OF TRIPS ON UNIT 2 AND TAKE CORRECTIVE ACTION TO REDUCE TRIPS

SCOPE

- o THE REVIEW INCLUDED ANALYSIS OF ALL TRIPS ON BOTH UNITS 1 AND 2, BUT FOCUSED PRIMARILY ON THE BALANCE OF PLANT EQUIPMENT

TRIP REDUCTION REVIEW

METHODOLOGY

- o MEETING HELD ON SEPTEMBER 23RD TO DEVELOP PLAN OF ACTION. MEETING CHAIRED BY PLANT MANGER. IN ATTENDANCE WERE NUCLEAR GROUP VICE PRESIDENT, OPERATIONS VICE PRESIDENT, NSRB CHAIRMAN, DIRECTOR OF ISEG, DEPARTMENT MANAGERS, PLANT OPERATORS, AND ENGINEERS
- o GROUP DISCUSSION LED TO FORMATION OF FOUR TEAMS WITH SPECIFIC INVESTIGATION RESPONSIBILITIES
- o TEAMS MET ALL DAY SEPTEMBER 23RD AND IN SOME CASES ALL DAY SEPTEMBER 24TH
- o ALL FOUR TEAMS MET ON MORNING OF SEPTEMBER 24TH TO DISCUSS FINDINGS
- o SEPTEMBER 24TH MEETING DETERMINED WHAT ACTIONS WERE REQUIRED FOR UNIT RESTART AND ACTIONS TO BE TAKEN ON A LONG TERM BASIS

TRIP REDUCTION REVIEW

TRIP ANALYSIS

o SCOPE

- EVALUATE ALL PLANT TRIPS FOR INDICATION OF TRENDS THAT COULD REVEAL CAUSE OF NUMBER OF TRIPS AND CAUSE FOR DIFFERENCE IN TRIP FREQUENCY BETWEEN UNIT ONE AND UNIT TWO

o METHODOLOGY

- DEVELOPED LIST OF POTENTIAL "CAUSAL FACTORS"
- DEVELOPED MATRIX DATA BASE FOR EACH TRIP USING TRIP REPORTS, LER'S
- TESTED EACH TRIP FOR EACH POTENTIAL "CAUSAL FACTOR"
- ANALYZED DATA FOR TRENDS

TRIP REDUCTION REVIEW

TRIP ANALYSIS

POTENTIAL CAUSAL FACTORS

- UNIT 1 FAILED EQUIPMENT WAS REPAIRED AND PUT INTO UNIT 2, RESULTING IN OLDER OR LESS RELIABLE EQUIPMENT IN UNIT 2.
(NOT CONFIRMED)
- MORE TRIPS OCCUR ON TUESDAY, A HIGH OVERTIME DAY FOR PLANT OPERATIONS.
(DID NOT CONTRIBUTE TO TRIP NUMBER OR FREQUENCY)
- UNIT 2 FAST TRIP RECOVERIES HAVE RESULTED IN LESS THAN ADEQUATE CORRECTIVE ACTIONS TO PREVENT RECURRENCE OF TRIPS (E.G. LESS THAN ADEQUATE INVESTIGATION OF GENERIC IMPLICATION OF CAUSES).
(WEAK CORRELATION)
- UNIT 2 OPERATING CULTURE OVER EMPHASIZES POWER PRODUCTION WHICH LEADS TO OPERATION WITH LESS MARGIN TO TRIPS.
(NOT CONFIRMED)
- STARTING IN JULY 1989 MANAGEMENT ATTENTION WAS DIVERTED TO PREPARATIONS FOR, AND PERFORMANCE OF, THE UNIT 1 REFUELING OUTAGE.
(DID NOT CONTRIBUTE TO TRIP NUMBER OR FREQUENCY)

TRIP REDUCTION REVIEW

TRIP ANALYSIS

POTENTIAL CAUSAL FACTORS

- o ON JULY 1, 1989 THE POSITION OF PLANT SUPERINTENDENT DEDICATED TO EACH UNIT WAS ELIMINATED. THIS ORGANIZATIONAL CHANGE MAY HAVE CONTRIBUTED TO THE INCREASE IN TRIPS.
(DID NOT CONTRIBUTE TO TRIP NUMBER OR FREQUENCY)
- o UNIT 2 PERFORMED THE PREOPERATIONAL/ACCEPTANCE TESTING PROGRAM TOO FAST, LEAVING THE PLANT NOT ADEQUATELY CHECKED OUT.
(NOT CONFIRMED)
- o THE HIGH MAINTENANCE BACKLOG HAS CONTRIBUTED TO THE NUMBER OF PLANT TRIPS.
(DID NOT CONTRIBUTE TO TRIP NUMBER OR FREQUENCY)

TRIP REDUCTION REVIEW TRIP ANALYSIS POTENTIAL CAUSAL FACTORS

- o THE PREVENTIVE MAINTENANCE PROGRAM HAS CONTRIBUTED TO THE NUMBER OF PLANT TRIPS.
(DID NOT CONTRIBUTE TO TRIP NUMBER OR FREQUENCY)
- o HIGH TEMPERATURE IN SENSITIVE EQUIPMENT CABINETS HAS CAUSED FAILURES LEADING TO PLANT TRIPS.
(NOT CONFIRMED)
- o REDUCING POWER TO GAIN MORE OPERATING MARGIN DURING CRITICAL EVOLUTIONS OR OTHER SPECIAL SITUATIONS WOULD HAVE PREVENTED SOME PLANT TRIPS.
(NOT CONFIRMED)
- o STP IS DESIGNED WITH LESS OPERATING MARGIN THAN OTHER PLANTS WHICH HAS INCREASED THE NUMBER OF PLANT TRIPS.
(NOT CONFIRMED)
- o ALLEGED TAMPERING HAS BEEN A FACTOR IN INCREASED NUMBER OF PLANT TRIPS.
(NOT CONFIRMED)

TRIP REDUCTION REVIEW

TRIP ANALYSIS

POTENTIAL CAUSAL FACTORS

- POOR MAINTENANCE PRACTICES HAVE CONTRIBUTED TO THE NUMBER OF PLANT TRIPS.
(NOT CONFIRMED)
- POOR OPERATIONS PRACTICES HAVE CONTRIBUTED TO THE NUMBER OF PLANT TRIPS.
(NOT CONFIRMED)
- DIFFERENCES BETWEEN THE CREWS WHO PERFORM MAINTENANCE ON THE UNITS CONTRIBUTE TO THE DIFFERENT TRIP FREQUENCIES BETWEEN UNITS.
(NOT CONFIRMED)
- CHANGES IN THE WAY WE ALLOCATE RESOURCES TO THE UNITS HAVE CONTRIBUTED TO THE DIFFERENT TRIP FREQUENCIES BETWEEN UNITS.
(NOT CONFIRMED)

TRIP REDUCTION REVIEW

TRIP ANALYSIS

TRIPS BY DAY OF THE WEEK

	<u>UNIT 1</u>	<u>UNIT 2</u>	<u>BOTH</u>
MONDAY	0	0	0
TUESDAY	4	3	7
WEDNESDAY	1	2	3
THURSDAY	0	1	1
FRIDAY	2	2	4
SATURDAY	0	1	1
SUNDAY	<u>1</u>	<u>0</u>	<u>1</u>
TOTAL	8	9	17

TRIPS HAVE OCCURRED ON TUESDAYS 41% OF THE TIME

TRIP REDUCTION REVIEW

TRIP ANALYSIS

TRIPS BY OPERATIONS SHIFT CREW

UNIT 2

<u>CREW</u>	<u>NO. OF TRIPS</u>
I	1
II	1
III	1
IV	2
V	4

- o CREW V ACCOUNTS FOR 41% OF UNIT 2 TRIPS
- o NO CREW V TRIPS WERE CAUSED BY INADEQUATE HUMAN PERFORMANCE
- o NO TRENDS DETECTED AT ALL

UNIT 1

TRIP REDUCTION REVIEW

TRIP ANALYSIS

TRIPS BY TIME OF DAY

	<u>UNIT 1</u>	<u>UNIT 2</u>	<u>BOTH</u>
DAY	4	3	7
EVENING	3	2	5
MIDNIGHT	1	4	5
	<u> </u>	<u> </u>	<u> </u>
TOTAL	8	9	17

- o DATA FOR BOTH UNITS INDICATE THAT TIME OF DAY IS NOT A FACTOR
- o A DIFFERENCE BETWEEN THE UNITS ON THE NUMBER OF TRIPS ON THE MIDNIGHT SHIFT WAS FOUND
- o ONLY 1 UNIT 2 TRIP ON THE MIDNIGHT SHIFT WAS CAUSED BY "HUMAN PERFORMANCE DEFICIENCY"
- o CONCLUSION WAS THAT TIME OF DAY IS NOT A CONTRIBUTOR TO THE NUMBER OF TRIPS

TRIP REDUCTION REVIEW

TRIP ANALYSIS

TRIPS BY TYPE OF INITIATOR (NSSS/BOP)

	<u>UNIT 1</u>	<u>UNIT 2</u>	<u>BOTH</u>
NSSS	2	2	4
BOP	6	7	13
TOTAL	8	9	17

- EVENTS IN THE BALANCE OF PLANT (BOP) HAVE INITIATED 76% OF THE PLANT TRIPS
- THIS TREND IS CONSISTENT BETWEEN UNITS
- THE TEAM NOTED THAT A CORRECTIVE ACTION FROM THE UNIT 1 MAIN GENERATOR FIRE TRIP WAS TO DEVELOP A BALANCE OF PLANT SURVEILLANCE PROGRAM

TRIP REDUCTION REVIEW

TRIP ANALYSIS

RESTART TIMES BY UNIT (IN HOURS)

	<u>UNIT 1</u>	<u>UNIT 2</u>
AVERAGE	35	20
MINIMUM	19	10

o UNIT 2 RESTARTS FROM A TRIP APPROXIMATELY TWICE AS FAST AS UNIT 1

TRIP REDUCTION REVIEW

TRIP ANALYSIS

TRIPS WHERE A MORE THOROUGH EVALUATION PRIOR TO RESTART COULD HAVE PREVENTED A FUTURE TRIP

	<u>UNIT 1</u>	<u>UNIT 2</u>	<u>BOTH</u>
NOT FEASIBLE	7	7	14
FEASIBLE BUT NOT LIKELY	0	2	2
LIKELY	<u>1</u>	<u>0</u>	<u> </u>
	8	9	17

o THE "LIKELY" PREVENTABLE TRIP ON UNIT 1 WAS ALSO THE FASTEST UNIT 1 RESTART

o THE FACT THAT UNIT 2 RESTARTS FASTER THAN UNIT 1 DOES NOT APPEAR TO CAUSE MORE TRIPS IN UNIT 2

TRIP REDUCTION REVIEW

TRIP ANALYSIS

POTENTIAL COMPONENT TRENDS

- o LIMIT SWITCH FAILURES CONTRIBUTED TO TWO PLANT TRIPS
- o POWER SUPPLY DIVERSIFICATION COULD HAVE PREVENTED TWO PLANT TRIPS
- o POWER SUPPLY TRANSFER SWITCH PROBLEMS CONTRIBUTED TO TWO PLANT TRIPS
- o LOOSE CONNECTIONS WERE IDENTIFIED DURING THE INVESTIGATION OF FIVE PLANT TRIPS

* NOTE THAT DEVELOPMENT OF A LOOSE LEAD DETECTION PROGRAM WAS IDENTIFIED AS A CORRECTIVE ACTION FOR THE MAIN GENERATOR FIRE

TRIP REDUCTION REVIEW SYSTEM DESIGN REVIEW

• SCOPE

- Review selected BOP systems to identify single point failure conditions which could result in a plant trip
- Identify for evaluation plant changes or compensatory measures to eliminate or mitigate single point failure possibility

- Systems Reviewed

- | | |
|-------------------------------|------------------------------|
| • Condensate/Condenser Vacuum | • Isophase Bus Cooling |
| • Circulating Water | • Generator Hydrogen Cooling |
| • Feedwater | • Stator Cooling Water |
| • Open Loop Cooling | • Generator Seal Oil |
| • Closed Loop Cooling | • Turbine |
| • Instrument Air | • Turbine Lube Oil |
| • Electro - Hydraulic Control | • Main Steam |
| • Steam Generator Blowdown | • Gland Steam |
| • Generator | |

TRIP REDUCTION REVIEW SYSTEM DESIGN REVIEW

• METHODOLOGY

- Review each system to identify the major components
- Identify the failure modes which would result in a plant trip
- Analyze each identified component failure for redundant protection design considerations:
 - ** Power feeds to components
 - ** Control power feeds
 - ** Control logic
 - ** Instrument air
 - ** Hydraulic fluid sources
- Compare each system review against the results of the failure modes and effects analysis (FMEA) of the turbine generator support systems in early 1989

• RESULTS

- A list of concerns and recommendations for plant changes was developed - two levels of concern were identified:
 - ** Single point failures which could result in a reactor trip
 - ** Other conditions which could substantially degrade or challenge plant operations
- The concerns were further evaluated in a session with all the review teams and recommendations were reclassified as either:
 - ** Prior to criticality
 - ** Prior to turbine roll
 - ** During a future outage
 - ** Action assigned for further evaluation

TRIP REDUCTION REVIEW: MAINTENANCE, INSPECTION, & TESTING

• SCOPE

- Identify maintenance activities, inspections, and tests to be performed prior to Unit restart to reduce the probability of a Unit trip

• METHODOLOGY

- Identify systems which can cause reactor trips directly or through a chain of events
- Review list of open work requests for each system to determine what maintenance should be performed prior to Unit restart
- Review list of deferred and inactive preventative maintenance work activities for each system to determine what maintenance should be performed prior to Unit restart
- Review the "Vibration Alert" list for equipment that is in any of the selected systems and determine appropriate action to be taken
- Identify equipment for visual inspection, thermographic inspection and component testing prior to Unit restart

TRIP REDUCTION REVIEW MAINTENANCE, INSPECTION & TESTING

● RESULTS

- Identified five work activity items to be performed prior to Unit 2 restart
- Identified six work activity items to schedule earlier, but not before restart
- No preventative maintenance activities were identified as being required prior to restart
- No components on the "Vibration Alert" list were identified as requiring immediate attention
- Thermographic & visual inspections results as follows

**TRIP REDUCTION REVIEW
MAINTENANCE, INSPECTION & TESTING
Thermography/Visual Inspection Results
Unit 2**

<u>Component Inspected</u>	<u>Inspection Results</u>	<u>Corrective Actions</u>
EAB Class 1E & Non-Class 1E Inverters	No noted discrepancies	None
TGB Non-Class 1E Inverter (EP 48A)	1.) Three relays appear aged 2.) Room HVAC working poorly.	1.) WR VC-114134 written to replace relays, awaiting parts 2.) WR HT-68409 written, scheduled to work on 10/3/89
SWBD 1A Battery Chargers	One charger out of service.	WR DA-59531 repaired
S/G Feedwater Pump Control Cabinet	No discrepancies	None
Main Turbine Emergency Trip Cabinet	No discrepancies	None
CP 10 Relays	1.) Loose wire on 87/UT2 Relay 2.) Loose wire on 50-51/UT Relay	1.) Lug tightened, PMT satisfactory 2.) Lug tightened, PMT satisfactory

TRIP REDUCTION REVIEW DESIGN CHANGE DOCUMENT REVIEW

● SCOPE

- Review outstanding design changes and design change requests for modifications that could preclude a single point failure from resulting in a plant trip
- Review temporary modifications to determine if a permanent modification would be more reliable and could decrease the likelihood of a trip

● METHODOLOGY

- Multidiscipline review team reviewed all outstanding design change requests, design changes, and temporary modifications

● RESULTS

- Four design changes identified to be implemented prior to Unit 2 restart
- Five design changes identified to be implemented prior to Unit 1 restart
- Five design changes identified to be implemented at next outage for each Unit
- Nine design changes identified for implementation/evaluation for each Unit in 1990

**TRIP REDUCTION REVIEW
DESIGN CHANGES
IMPLEMENTED PRIOR TO UNIT 2 RESTART**

TURBINE GOVERNOR VALVE LOCKING BAR

Install anti-rotation bar on spacer link arm on main turbine governor valve to prevent loss of valve control

REDUNDANT POWER TO TURBINE TRIP CABINET

Turbine trip system cabinet power is supplied from a single distribution panel (DP-002) - provide independent supplies so that failure of single inverter will not trip the turbine

REDUNDANT POWER TO INVERTERS WHICH SUPPLY TURBINE TRIP SOLENOID VALVES

Turbine trip solenoids are not powered from independent sources - change wiring to prevent turbine trip on failure of one breaker

2/3 TRIP STATOR COOLING WATER

Change generator stator cooling trip circuitry to 2 of 3 from 1 of 2 to prevent generator trip due to a single failure of one pressure switch

**TRIP REDUCTION REVIEW
DESIGN CHANGES TO BE
IMPLEMENTED AT NEXT UNIT OUTAGE**

EHC PRESSURE SWITCH FAILURE

Replace SOR pressure switches in turbine EHC System due to problems with diaphragms and o-rings

WATER ENTRY INTO FW ELECTRICAL BOXES

Prevent water from entering and terminal boxes and from draining to feedwater reg. valve solenoid and limit switch enclosure

FWIV TEST CIRCUIT CHANGE

Add TD relay to FWIV Test circuit to prevent FWIV from closing on limit switch failure

FEED PUMP TURBINE TRIP LINKAGE PROTECTION

Protect FP Turbine trip linkage for accidental actuation that could cause a turbine trip

HYDROGEN COOLING TEMPERATURE CONTROLLER FAILURE

Replace thermocouple with an RTD to eliminate the circuitry amplifying minor noise spikes causing the control loop to fail to manual

**TRIP REDUCTION REVIEW
DESIGN CHANGES
IMPLEMENT/EVALUATE IN 1990 FOR EACH UNIT**

BOOSTER PUMP CASING VENT VIBRATION

Shorten piping and eliminate flanges on feedwater booster pump casing vent to prevent vibration and possible failure

COOLING FOR PROCESS CONTROL CABINETS

Install forced air cooling for Westinghouse 7300 process control cabinets to minimize failure rate of circuit cards and possible trips

SEPARATE POWER TO TURBINE ELECTRICAL OVERSPEED TRIP SOLENOIDS

Provide a separate power supply to the turbine electrical overspeed trip CPC solenoids

GENERATOR RETAINING RINGS

Replace main generator retaining rings with new material to reduce stress corrosion cracking potential

NEW SPRINGS FOR MFP STOP VALVES

Replace Main Feed Pump HP stop valve springs with increased tension springs

**TRIP REDUCTION REVIEW
DESIGN CHANGES
IMPLEMENT/EVALUATE IN 1990 FOR EACH UNIT**

CIRCULATING WATER VALVE LOCKING CLAMPS

Add locking clamp to Circulating Water Butterfly valve shafts to prevent operator from disengaging from valve stem

TURBINE LUBE OIL VALVE FAILURE

Failure of valve could restrict turbine lube oil flow

STATOR COOLING WATER CHECK VALVE REPACKING

Confirm that Stator Cooling Water check valves on pump discharge have been repacked to prevent disc shaft binding

Complete - valves repacked for both units

FAILURE OF BACKUP POWER SUPPLY TO ROD CONTROL SYSTEM

Provide method to identify failure of the Lambda power supply

TRIP REDUCTION REVIEW CONCLUSIONS

- o THE MAJORITY OF THE TRIPS HAVE BEEN A RESULT OF COMPONENT FAILURES IN DIFFERENT PIECES OF EQUIPMENT
- o LOOSE CONNECTIONS HAVE CONTRIBUTED TO FIVE PLANT TRIPS
- o NON-FAULT TOLERANT DESIGN HAS CONTRIBUTED TO FIVE PLANT TRIPS
- o SEVENTY-SIX PERCENT OF THE PLANT TRIPS WERE A RESULT OF PROBLEMS IN THE BALANCE OF PLANT EQUIPMENT
- o CORRECTIVE MAINTENANCE BACKLOG AND PREVENTATIVE MAINTENANCE DIFFERALS DID NOT CONTRIBUTE TO ANY PLANT TRIP
- o IMPLEMENTATION OF PLANT RELIABILITY IMPROVEMENT ITEMS MUST BE GIVEN A HIGHER PRIORITY

TRIP REDUCTION REVIEW CONCLUSIONS

- SEVERAL SINGLE POINT FAILURE CONDITIONS WHICH COULD CAUSE A REACTOR TRIP WERE IDENTIFIED. EVALUATIONS OF POSSIBLE SOLUTIONS ARE IN PROGRESS
- IN GENERAL, MOST SINGLE POINT FAILURE CONDITIONS WERE IDENTIFIED BY A FMEA PERFORMED AS A RESULT OF THE GENERATOR FIRE ON UNIT 1
- A NUMBER OF SINGLE POINT FAILURE TRIPS ARE PURPOSELY BUILT INTO THE PLANT PROTECTIVE SYSTEMS (EXAMPLES: GENERATOR PROTECTIVE RELAYS AND FEEDWATER ISOLATION VALVE CONTROLS)
- A GREATER CONFIDENCE IN THE DESIGN OF THE BALANCE OF PLANT WAS GAINED AS A RESULT OF THIS REVIEW

STPEGS
NSRB REVIEW

STPEGS

NSRB CONCLUSIONS

- o MANAGEMENT ACTION TIMELY
- o MANAGEMENT ACTION APPROPRIATE FOR RESTART OF UNIT 2 BASED ON CONTINUED EVALUATION BY PLANT RELIABILITY COMMITTEE

STPEGS

NSRB

RECOMMENDATIONS/ACTION ITEMS

- REACTIVATE PLANT RELIABILITY COMMITTEE AND CONTINUE FOR LIFE OF PLANT
- PLANT RELIABILITY COMMITTEE TO ROUTINELY ANALYZE CAUSAL FACTORS OF REACTOR TRIPS FOR TRENDS
- STATION MANAGEMENT TO DEVELOP GUIDELINES TO GAIN OPERATING MARGIN DURING CRITICAL EVOLUTIONS
- REVIEW VENDOR TECHNICAL INFORMATION TO VERIFY PROPER PRIORITIES OF ACTION ITEMS
- PERIODICALLY REVIEW MAINTENANCE AND MODIFICATION BACKLOG TO VERIFY PROPER PRIORITIES
- BOP ENGINEERING/DESIGN CRITERIA EQUIVALENT/COMPARABLE TO NUCLEAR GUIDANCE SHOULD BE CAPTURED IN DESIGN PROCEDURES AS IT IS DEVELOPED
- DEVELOP A FINAL REPORT FOR TRIP REDUCTION EVALUATION PERFORMED TO DATE WHICH ADDRESSES DISPOSITION OF RECOMMENDATIONS OF REVIEW TEAMS AND SUBMIT TO NSRB FOR REVIEW