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FACIL:50-387 Susquehanna Steam Electric Station, Unit 1, Pennsylva 05000387
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SUBJECT: LER 88-016-00:on 880727,main steam line leak detection differential temp sys design deficiencies.
W/8 ltr.

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TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

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LICENSEE EVENT REPORT (LER)

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TITLE (4)

Main Steam Line Leak Detection Differential Temperature System Design Deficiencies

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 7	2 7	8 8	8 8	— 0 1 6	— 0 0	0 8	2 6	8 8		0 5 0 0 0
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OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL (10) 1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
	20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)		
	20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
	20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)			
	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
	AREA CODE
Glenn G. Shaffer, Power Production Engineer - Compliance	7 1 7 5 4 2 - 3 7 5 9

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CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		1 1	0 1	8 8

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

On July 26, 1988 a deficiency was detected on Unit 1 and 2 of the Susquehanna Steam Electric Station with the Main Steam Line Leak Detection System. The Differential Temperature (DT) subsystem of the subject Leak Detection System was determined to be inoperable on both Unit 1 and 2 because installation of the trip channels was such that an actual DT condition would not be detected. The appropriate corrections were made by rewiring the circuits on July 27, 1988. Further evaluation determined that the location of the temperature elements which input to the Main Steam Line Leak Detection System DT Subsystem on Unit 2 rendered the isolation setpoints unconservative. The isolation setpoints were recalculated and the trip units were recalibrated based on the new setpoint calculations.

A task team has been formulated to review these events and the entire Leak Detection System. Determination of the root cause and appropriate long-term corrective actions will be performed in order to prevent recurrence.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

INTRODUCTION

On July 26, 1988 a deficiency was identified on Unit One and Unit Two of the Susquehanna Steam Electric Station with the Main Steam Line (MSL) (EIIS: SB) Leak Detection System. Inspection revealed that the MSL Differential Temperature (DT) portion of the Leak Detection System was installed such that the circuit would not detect a DT condition. Subsequent evaluation determined that the temperature elements (TE's) which input to the DT circuits on Unit Two differed in location from those in Unit One and that the Unit Two isolation setpoints were unconservative. It was concluded that the MSL DT portion of the Leak Detection System was unable to perform its design function since initial startup of both Units.

These findings were determined to be reportable per 10CFR50.73(a)(2)(v).

During the period of time that the MSL DT portion of the Leak Detection System was inoperable, the MSL High Ambient Temperature portion was uneffected and remained operable.

The purpose of the Leak Detection System is two fold as described in Chapter 7 of the Final Safety Analysis Report (FSAR). The first purpose is "to prevent the gross release of radioactive material in the event of a breach in the RCPB (Reactor Coolant Pressure Boundary) by automatically isolating the appropriate pipelines that penetrate the primary containment." The second purpose is to maintain the integrity of the fuel by ensuring inventory preservation. The MSL System is designed to detect a leak of twenty-five (25) gallons per minute (gpm).

MSL Leak Detection is accomplished in both the Reactor Building and Turbine Building portions of the MSL Tunnel. The Reactor Building portion monitors both Differential Temperature and Ambient Temperature while the Turbine Building portion monitors Ambient Temperature only. The Differential Temperature system is comprised of four pairs of dual element thermocouples consisting of Copper and Constantan elements. Each pair comprises one trip channel while two trip channels comprise one trip system. An isolation signal is generated when at least one trip channel in each of the two trip systems actuates (one-out-of-two twice logic). The result of the isolation signal is isolation of the Main Steam Lines via closure of the Main Steam Isolation Valves (MSIV's) and Main Steam Line Drains.

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TEXT *(If more space is required, use additional NRC Form 366A's)* (17)

DEFICIENCY DETECTION/CORRECTIVE ACTIONS

On June 24, 1988 the Systems Engineering Group published a report entitled "The Development of a Reliability Engineering Capability - A Progress Report for the Addition of the Main Steam System." The report consisted of an intensive study of the Main Steam System and its support systems. During the evaluation process the determination was made that proper operation of the Unit Two MSL Leak Detection System was dependent upon sufficient air flow past the TE's created by placing both MSL Tunnel Cooler Fans in-service. Air flow resulting from fan operation creates a differential temperature across the MSL Tunnel Coolers resulting in the downstream TE being subjected to a colder temperature. Each fan and associated set of cooling coils contains a trip channel (pair of TE's) from each trip system. Technical Specifications requires all four trip channels operable to satisfy minimum operability requirements. Thus, it was concluded both MSL Tunnel Cooler Fans should be placed in-service to satisfy Technical Specification requirements in Conditions 1, 2, and 3. The dependence on maintaining both fans in service was previously not recognized. On July 12, 1988, the Systems Engineering Group generated a Technical Specification Interpretation Request (TSIR) to trigger an evaluation of this operability requirement.

Investigation of the differences between Unit 1 and Unit 2 by the System Engineer on July 26, 1988 revealed that all four DT instruments on the Control Room Backpanel of each unit (1(2)C614) indicated zero degrees as the differential temperature. Subsequent evaluation by the Shift Technical Advisor (STA) on the morning of July 27, 1988 disclosed that even though the MSL DT circuits were wired per the General Electric (GE) Elementary drawings, the circuit was unable to detect an actual differential temperature. It was revealed that the wiring to the DT switch produced a negative differential temperature as the warmer TE value was subtracted from the cooler TE value. The output of the op-amp in the circuit resulted in a value of zero degrees on the indicating module. As a result, it was perceived that a differential temperature of zero existed. In actuality, the DT process was not monitored accurately and the MSL DT isolation would not have occurred.

Immediate corrective action was taken to correct the deficiency. A plan was developed to investigate the actual input to each DT trip unit and if the deficient condition was confirmed, to correct the condition by reversing TE inputs to each trip unit. Limiting Conditions of Operations (LCO's) were entered on a channel-by-channel basis. After entering an LCO on a particular channel, the wiring reversal was verified and the appropriate correction was made. The first LCO for Unit Two was entered at 1323 on July 27, 1988 and the last was cleared at 1515. Unit One followed as the LCO's were entered and cleared between 1605 and 1805. Upon completion of the corrective action each channel was verified to indicate a positive value on the control room meter. The NRC was notified via the Emergency Notification System (ENS).

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Further review resulted in identification of additional deficiencies on the Unit 2 system. Three points of concern were identified.

1) The location of the TE's were not in accordance with the FSAR.

2) Based on the location of the Unit Two cold leg TE's at the MSL Tunnel Cooler outlet, the Unit Two isolation setpoints for DT would not be reached under a postulated steam leak as determined by an Engineering calculation.

3) With the physical configuration on Unit 2, MSL Cooler Fan Operation was required in order to achieve proper operation of the DT circuit.

These conditions were documented on a plant Nonconformance Report. At 2245 on July 29, 1988 all four channels of the MSL DT System were declared inoperable.

Corrective actions were taken to rectify the deficiencies identified. A Technical Specification Interpretation was generated which specified operation of both MSL Tunnel Cooler Fans in order to meet minimum OPERABILITY requirements for the MSL DT isolation channels. Operations personnel ensured that both Unit Two fans were in-service. Procedure changes were made to reflect the need to maintain both fans in-service. Setpoint changes were calculated by Nuclear Plant Engineering to compensate for the altered TE locations on Unit Two to allow the DT circuit to perform its intended design function. The setpoint of the trip unit was revised in accordance with the new setpoint calculations. The LCO was cleared at 0200 on July 30, 1988 following completion of all of these corrective actions.

A task team was formulated to review the subject of steam leak detection. An in-depth review of all leak detection systems will be performed, including the Reactor Water cleanup (RWCU), Residual Heat Removal (RHR), Reactor Core Isolation Cooling (RCIC), High Pressure Coolant Injection (HPCI), and Main Steam Line (MSL) Leak Detection Systems. Walkdowns will be performed to document the existing leak detection system configurations. A review of historical information will be performed to determine the cause of the difference between Unit One and Unit Two in the MSL DT cold leg TE locations. Calculations and design bases will be reviewed for adequacy. Determination of the root cause and appropriate long-term corrective actions will be performed. An assessment will be made on the broader issues associated with this event. The findings of this task team will be reported in a followup to this LER.

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SAFETY SIGNIFICANCE/ANALYSIS

Section 7.3.1.1a.2.4.1.3 of the FSAR provides discussion on the various methods of leak detection available to detect a steam leak. "Diversity of trip initiation signals for main steamline break is provided by main steamline tunnel temperature, high differential temperature, main steamline high flow, low pressure instrumentation and reactor vessel low low water level, Level 2. An increase in tunnel temperature, Reactor Building Steam tunnel differential temperature, main steamline flow, or a decrease in pressure will initiate main steamline and main steamline drain valve isolation." With exception of the tunnel differential temperature detection, the remaining safety systems were in tact to detect a breech in the Main Steam Lines and to generate the MSL isolation if required.

Preliminary evaluation has determined that high ambient temperature may be redundant to DT for the MSL Leak Detection System. Both subsystems are designed to detect a leak of twenty-five (25) gpm and to isolate the Main Steamlines and MSL Drains. The high ambient temperature subsystem is provided input by four dual element thermocouples which are located in the MSL Pipe Tunnel. The high ambient temperature subsystem functions independent of the DT subsystem and remained operable since startup as an alternate means of providing leak detection.

ADDITIONAL INFORMATION

A review of past Licensee Event Reports (LER) identified no past similar occurrences.

PP&L Pennsylvania Power & Light Company
Two North Ninth Street • Allentown, PA 18101 • 215/770-5151

August 26, 1988

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 88-016-00
FILE R41-2
PLAS-334

Docket No. 50-387
License No. NPF-14

Attached is Licensee Event Report 88-016-00. This event was determined reportable per 10CFR50.73(a)(2)(v) in that the Main Steam Line Differential Temperature Leak Detection System was determined inoperable due to the identification of design deficiencies.

R. G. Byram
Superintendent of Plant - Susquehanna

GGS/mjm

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