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Reactor	Trips on Steam Gene	rator Low Water Level								
EVENT DATE (5)	LER NUMBER (6)	REPORT DATE (7)	OTHER	FACILITIES IN	VOLVED (8)					
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atmospheric ste main feedwater generator water EOP 2525, "Si placed in a sta "A" steam gen	am dump valve (AD) pump automatically r level occurred at 01 andard Post Trip Act ble condition. The c perator following the t	V) failed open. During tripped on low suction p 51 hours. Operators th tions." All safety related ause of the reactor trip rip of the "B" main lee	the subsequent transference in an 10002 power pressure, and an auter en performed Emer d equipment respon was the inability to dwater pump	isient plant omatic read gency Oper ded as expe recover the	conditions, conditions, ctor trip on ating Proces scted and the water level	the "E low ste lure ne unit in the	t" tam was			
During the sub power, high vit was quickly red subsequent tran 2043 bours	sequent plant startup pration of several mai duced to approximate nsient plant condition perators then perform	on February 23, 1993, n turbine bearings requi ly 14% power and the n s, an automatic reactor med Emergency Omeration	at 2037 hours, with red shutdown of the hain turbine was trip trip on low steam g or Procedure FOP	the plant i main turb oped at 204 enerator wa	n Mode 1 a ine. Reacto 0 hours. D ter level oci dard Poet 7	it 18% it powe luring i curred	er the at			

Actions." All safety related equipment responded as expected and the unit was placed in a stable condition. The cause of the reactor trip was insufficient feedwater flow to the steam generators for the explace reactor power level.

These events are being reported pursuant to the requirements of Paragraph 50.73(a)(2)(iv), reporting any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature System.

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1 Description of Event							

On February 22, 1993, at 0144 hours, with the plant in Mode 1 at 100% power, the "A" steam generator atmospheric steam dump valve (ADV) failed open. The ADV failure caused the indicated steam flow rate to decrease and the feedwater level control system to automatically decrease feedwater flow to the "A" steam generator, thus decreasing the steam generator water level. The operators then took manual control of the "A" steam generator feedwater control valve in an effort to restore steam generator water level. During the subsequent transient, the "A" steam generator water level increased to the high level setpoint, causing the feedwater control valve to automatically close and the water level to decrease. After the "A" steam generator feedwater control valve was reopened, excessive feedwater flow rates caused the "B" main feedwater pump to automatically trip on low suction pressure, resulting in an automatic reactor trip on low steam generator water level at 0151 hours. Operators then performed Emergency Operating Procedure EOP 2525, "Standard Post Trip Actions." Auxiliary feedwater automatically initiated with no complications. All safety related equipment responded as expected and the unit was placed in a stable condition.

During the subsequent plan, startup, on February 23, 1993, at 2037 hours, with the plant in Mode 1 at 18% power, high vibration of several main turbine bearings required shutdown of the main turbine within 15 minutes. Reactor power was quickly reduced to approximately 14% power and the main turbine was tripped at 2040 hours. Following the main turbine trip, the steam generator pressures increased, causing the differential pressure between the main feedwater pump and the steam generators to decrease, and consequently decreasing the feedwater flow rate to the steam generators. Additionally, the operators were initially concerned about overfeeding the steam generators, and stopped the automatic actions of the feedwater control system and consequently only partially opened the feedwater bypass control valves. When them generator levels were observed to be decreasing, the feedwater flow rates were then increased. Due to differences in the feedwater bypass valve positions between the two steam generators, more feedwater flow was directed to the "B" steam generator and the "A" steam generator water level did not recover prior to reaching the low level trip setpoint. An automatic reactor trip on low steam generator water level occurred at 2043 hours. Operators then performed Emergency Operating Procedure EOP 2525, "Standard Post Trip Actions." All safety related equipment responded as expected and the unit was placed in a stable condition.

## Cause of Event

Le root cause of the automatic reactor trip on low steam generator water level on February 22, 1993, was the automatic trip of the "B" main feedwater pump on low suction pressure due to the high feedwater flow rates being demanded to recover steam generator water levels.

The cause of the initiating event on February 22, 1993, was the "A" steam generator ADV failing open. The ADV failed open when the spring attachment fitting broke at the point where the spring attaches to the inner diaphragm assembly. The break at the attachment point resulted from a combination of misalignment of the feedback spring and bending of the range spring attachment (possibly during installation), and positioner vibration during normal plant operation. See Figure 1 for a diagram of the AEV valve positioner.

The root cause of the automatic reactor trip on low steam generator water level on February 23, 1993, was insufficient feedwater flow to the steam generators for the existing reactor power level. Several contributing factors were involved in this root cause:

 Following the main turbine trip, steam generator pressures increased, causing the differential pressure between the main feedwater pump and the steam generators to decrease, and consequently decreasing the feedwater flow rate to the steam generators.

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Subsequent to a turbine trip signal, the main feedwater regulating valves automatically close, and the feedwater regulating bypass valves automatically open to approximately 75%. The operators were initially concerned about overfeeding the steam generators, and stopped the automatic actions of the feedwater control system and consequently only partially opened the feedwater regulating bypass valves. When steam generator levels were observed to be decreasing, the feedwater flow rates were then increased. Due to differences in the feedwater bypass valve positions between the two steam generators, more feedwater flow was directed to the "B" steam generator and the "A" steam generator water level did not recover prior to reaching the low level trip setpoint.

A contributing cause to both events was an unfamiliarity by the operators to feedwater transients involving the new steam generators. During licensed operator training on the new steam generators, the operators were informed that the transient water level response of the new steam generators would be more stable when compared to the original steam generators. This statement is correct for water levels greater than 50%, but is incorrect for water levels less than 50%, where the level changes are much more rapid and more indicative of the response observed on the original steam generators.

The cause of the high main turbine bearing vibration *i*, pears to be a turbine "rub." The turbine was placed on the turning gear and was restarted on February 24, 1993 with no problems.

## III. Analysis of Event

These events are being reported pursuant to the requirements of Paragraph 50.3(a)(2)(iv), reporting any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature System.

There were no safety consequences from these reactor trip events. All safety related equipment responded as expected and plant operators executed applicable Emergency Operating Procedures accordingly.

## IV. Corrective Action

The valve positioner for the "A" steam generator ADV was replaced and the feedback spring was realigned. The valve positioner for the "B" steam generator ADV was replaced, and the as found feedback spring alignment was satisfactory.

Operator shift briefings were conducted to provide information on the observed steam generator level response during the transient conditions. The water level response for the new steam generators, which were installed during the previous refueling outage, is as follows:

- For indicated steam generator water levels greater than 50% (moisture separator region), the indicated level changes are slower when compared to the original steam generators.
- For indicated steam generator water levels less than 50% (downcomer region), the indicated level changes are the same as the original ster generators.
- For indicated steam generator water levels in the downcomer region (less than 50%), the indicated level changes are significantly faster as compared to changes in the moisture separator region (greater than 50%).

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Additional act	ions implemented to preve	nt recurrence were a	is follows:
a) The ADV (PMMS)	Positioners have been ad and will be replaced every	ded onto the Produc outage	tion Maintenance Management System
<li>b) All license generatori will affect</li>	ed operators have received s with emphasis placed on level response.	specific classroom t how the differences	raining on the construction of the new steam between the old and new steam generators
In additio steam gen training h upgraded generators transients	on, specific classroom train herator response has been to as been received by all ex- to represent the changes to s. Normal/routine simulate	ing on Main and Au received by all licens cept one licensed op n level control which or training will furthe	exiliary Feedwater Controls emphasizing sed operators and associated simulator erator. The simulator model has been resulted from the replacement of the steam or enhance the operators' response to level
The final	operator is scheduled to re	eceive the specific si	mulator training during the month of July.
The comb necessary	bination of the classroom a knowledge to accurately c	nd simulator training ontrol level in the n	g will provide the operators with the ew steam generators.
V. Additional Inf.	ormation		
Similar LERS:	87-12, 87-11, 87-09, 87	-02	
EIIS Codes fo	r referenced components:		
Atmosphe	eric Steam Dump Valve: S	B-PCV-C635	
<ul> <li>Feedwate</li> </ul>	r Control Valve: \$J-FCV-	C635	
Main Fee	edwater Pump: SJ-P-1075		
• Main Tur	bine: TA-TG-G084		
The following	component failed during th	his event:	
Atmospheric 5	Steam Dump Valve Position	ner	
Manufacturer	Moore Industries		
Model: 12372	-74GS10GC		
EIIS Code: SI	B-0084-M422		



Figure 1 Atmospheric Steam Dump Valve Positioner