



Nuclear Group
P.O. Box 4
Shippingport, PA 15077-0004

Telephone (412) 393-6000

September 27, 1996
NPD2VPO:0529

Beaver Valley Power Station, Unit No. 2
Docket No. 50-412 Licensee No. NPF-73
LER-96-004-00

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

In accordance with Appendix A, Beaver Valley Technical Specifications, the following Licensee Event Report is submitted:

LER 96-004-00, 10 CFR 50.73.a.2.iv, "Bypass Feedwater Regulating Valve Leakage Leads to Manual Reactor Trip During Shutdown for Refueling."

T. P. Noonan
Division Vice President
Nuclear Operations/Plant Manager

LB/jd

Attachment

JE22/1

9610020067 960927
PDR ADOCK 05000412
S PDR

September 27, 1996

NPD2VPO:0529

Page 2

cc: Mr. H. J. Miller, Regional Administrator
United States Nuclear Regulatory Commission
Region 1
475 Allendale Road
King of Prussia, PA 19406

Mr. D. S. Brinkman
BVPS Licensing Project Manager
United States Nuclear Regulatory Commission
Washington, DC 20555

Mr. David Kern
BVPS Senior Resident Inspector
United States Nuclear Regulatory Commission

Mr. J. A. Hultz
Ohio Edison Company
76 S. Main Street
Akron, OH 44308

Mr. Mark Burns
Centerior Energy Corporation
6200 Oak Tree Boulevard
Independence, OH 44101-4661

INPO Records Center
700 Galleria Parkway
Atlanta, GA 30339-5957

Mr. Robert Maiers
Department of Environmental Resources
P.O. Box 8469
State Office Building, 13th Floor
Harrisburg, PA 17105-8469

Director, Safety Evaluation & Control
Virginia Electric & Power Company
P.O. Box 26666
One James River Plaza
Richmond, VA 23261

EXPIRES 04/30/98

LICENSEE EVENT REPORT (LER)

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

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 (MNB 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.

FACILITY NAME (1) Beaver Valley Power Station Unit 2										DOCKET NUMBER (2) 05000412		PAGE (3) 1 OF 4		
TITLE By-pass Feedwater Regulating Valve Leakage Leads to Manual Reactor Trip During Shutdown for Refueling														
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 NAME Beaver Valley Power Station Unit 1			DOCKET NUMBER 05000334		
08	30	96	96	004	00	09	27	96	N/A					
OPERATING MODE (9)		2		20.402(b)		20.405(c)		X		50.73(a)(2)(iv)		73.71(b)		
POWER LEVEL (10)		<1%		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)		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 T. P. Noonan, Vice President Nuclear Operations and Plant Manager										TELEPHONE NUMBER (include Area Code) (412) 393-7622				
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				
B	SJ	FCV	M120	Yes										
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
YES (if yes, complete EXPECTED SUBMISSION DATE)				X NO										
ABSTRACT (Limited to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)														
<p>During a refueling outage shutdown on August 30, 1996, at 2041 hours, Beaver Valley Power Station Unit 2 initiated a manual reactor trip, as a conservative action, when the average reactor coolant temperature (T_{ave}) reached 541°F. The generator output breakers were opened at 1921 hours. Reduced steam flow to the high pressure turbine, due to the governor valves closing to maintain synchronous speed (1800 RPM), resulted in reduced extraction steam to the high pressure (HP) feedwater heaters. Combined with reduced heater drain flows, this caused feedwater temperature to decrease, as expected. Turbine pedestal testing commenced at 1930 hours, and upon completion, the turbine was tripped at 2004 hours. At 2036 hours, the "A" steam generator wide range level started increasing above 65%, due to a leaking bypass feedwater regulating valve. Feedwater leakage, in conjunction with routine reactor power reduction from control rod insertion, caused a power mismatch and the decline in T_{ave}.</p> <p>The apparent cause of this event was a leaking bypass feedwater regulating valve, combined with a lack of procedural guidance for the control of the consequential excess feedwater.</p> <p>Corrective actions for this event include: 1) procedures will be revised to provide the operator with guidance for earlier warning capabilities for the detection and for the correction of feedwater leakage or steam header leakage, 2) procedures will be revised to isolate blowdown to help steam generators attain isothermal temperatures prior to reactor shutdown, 3) procedure changes were validated on the simulator prior to implementation, 4) leakage through the bypass feedwater regulating valve will be monitored and evaluated during the upcoming startup, since leakage and "AIRCET" (air operated valve actuator testing and analysis) testing performed under cold conditions did not confirm the existence of excessive leakage.</p> <p>This event was reported pursuant to the requirements of 10CFR50.72(b)(2)(ii) as an event or condition that results in a manual or automatic actuation of an Engineered Safety Feature (ESF), including the Reactor Protection System (RPS). This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv) as an event that resulted in manual or automatic actuation of an ESF, including the RPS.</p>														

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Beaver Valley Power Station Unit 2	05000412	96	004	00	2 OF 4

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

PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor (PWR)

Main Turbine System {TA}*

Feedwater System {SJ}*

Main Turbine {TA/TRB}*

Main Turbine Governor {TA/65}*

High Pressure Feedwater Heater and MSR Drains and Vents System {SN}* Heater Drains {SN/DRN}*

HP Feedwater Heat Exchanger {SN/HX}*

Steam Generator {SB/SG}*

Steam Generator Blowdown System - {WI}*

* Energy Industry Identification System (EIIS) codes and component function identifier codes appear in the text as {SS/CCC}.

CONDITIONS PRIOR TO OCCURRENCE:

Unit 2: Mode 2, <1% power

There were no structures, systems or components that were inoperable at the beginning of this event that contributed to the event.

DESCRIPTION:

On August 30, 1996, Beaver Valley Power Station Unit 2 was conducting a plant shutdown for a refueling outage. The generator output breakers were opened at 1921 hours, in preparation for turbine pedestal testing. Reduced steam flow to the high pressure turbine {TA/TRB}, due to the governor valves {TA/65} closing to maintain synchronous speed (1800 RPM), resulted in reduced extraction steam to the high pressure (HP) feedwater heaters {SN/HX}. Combined with reduced heater drain {SN/DRN} flows, this caused feedwater temperature to decrease, as expected. Turbine pedestal testing commenced at 1930 hours. Following the completion of pedestal testing, the turbine was tripped at 2004 hours. At 2036 hours, the "A" steam generator {SB/SG} wide range level started increasing above 65%, indicating that feedwater was being added. Feedwater leakage, in conjunction with the routine reduction in reactor power, which was already below 1% power from control rod insertion, caused a power mismatch and the decline in T_{ave} . At 2041 hours, when T_{ave} decreased to 541°F, a manual reactor trip was initiated, as a conservative action. Technical Specifications allow T_{ave} to be below 541°F for 15 minutes when the reactor is critical. However, an automatic ESF actuation (feedwater isolation due to hi-hi steam generator level) was avoided by timely crew diagnostics and corrective actions.

Steam generator blowdown {WI} was isolated at 2047 hours, in an attempt to reverse the temperature transient. Normally this would reduce the effect of the temperature decrease, especially when blowdown temperatures are high, but this was not the case, since feedwater temperature was below 127°F at this time.

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

FACILITY NAME (1)		DOCKET NUMBER (2)		LER NUMBER (6)			PAGE (3)
Beaver Valley Power Station Unit 2		05000412		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 4
				96	004	00	

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

The operations crew performing the shutdown, determined, in a timely manner, that the "A" bypass feedwater regulating valve (2FWS-FCV479) {SJ/FCV} was leaking by, after the reactor trip at 2049 hours. The bypass feedwater regulating valve block valve to the "A" steam generator was closed at approximately 2051 hours.

CAUSE OF EVENT:

The apparent cause of this event was a leaking bypass feedwater regulating valve, combined with a lack of procedural guidance for the control of the consequential excess feedwater.

At 2018 hours, with the reactor power at 7.33%, the differential temperature (ΔT) or hot leg temperature minus cold leg temperature ($T_h - T_c$) on the "B" steam generator was zero, and at 2039 hours, with reactor power at 1.43%, the "C" steam generator ΔT was similarly zero. This left "A" steam generator as the only steam generator being "steamed off", and consequently, the steam generator receiving the most feedwater, which continued with feedwater temperature now below 127°F. At 2036 hours, the "A" steam generator narrow range dropped below 50%, but the wide range level started increasing above 65%, which indicates feedwater was being added to the "A" steam generator. It was this feedwater leakage, in conjunction with the routine reduction in reactor power from control rod insertion, that caused the power mismatch, and the T_{ave} decline.

ANALYSIS OF THE EVENT:

Since this event involved a manual reactor trip, it is reportable pursuant to the requirements of 10CFR50.73(a)(2)(iv) as "Any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)..."

For a refueling outage shutdown, the turbine is maintained at synchronous speed to perform turbine pedestal testing. This has the effect of delaying the turbine trip until the test is complete. The pedestal testing commenced at 1930 hours and, upon completion of the testing, the turbine was tripped at 2004 hours. Normally the generator trip and turbine trip are performed within a few minutes of each other, and feedwater temperature reduction has no significant impact. This is due to feedwater rates being reduced by the operator, once the turbine is tripped and followed up by the reactor shutdown.

In accordance with a "Caution" statement in shutdown procedure 2OM-52.4.C, "Decreasing Power from $\leq 40\%$ to Turbine Shutdown and Reactor at Approximately 5% Power," steam generator levels are maintained in the 40% - 50% of narrow range level prior to opening the generator main output breakers. This is intended to prevent a lo-lo steam generator level reactor trip when steam pressure increases to the condenser steam dump setpoint, after tripping the turbine. After the generator trip transient effects have been stabilized, there is no procedural requirement to reduce steam generator levels to their program values, i.e., 33%, at lower power levels. Steam generator levels were largely maintained in this range. The effects of the feedwater leakage through the bypass regulating valve caused level control on the "A" steam generator to be more difficult when power was reduced, as feed flow rates, due to leakage, exceeded steam flow after the last steam dump valve closed.

This increase in secondary mass inventory can be observed on the wide range steam generator level response as a continuous increase above the 65% expected value for this condition. The increase in steam generator level was also amplified by the effects of the decline in steam pressure, that started when the last steam dump valve went closed at 2041 hours, and the bypass feedwater regulating valve leakage. In addition, steam generator blowdown was in service until 2047 hours, creating a need for intermittent feedwater additions to replace this steam generator inventory loss, over and above the feedwater additions necessary to replace inventory losses to the main steam system.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Beaver Valley Power Station Unit 2	05000412	96	004	00	4 OF 4

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

Therefore, the steam generator mass inventory represented an increasingly larger heat sink. At 2039 hours, when reactor power went below 1%, the heat removal rate from the primary system (due to low power and bypass feedwater regulating valve leakage) exceeded the primary heat production rate and caused the ensuing drop in reactor coolant temperature.

CORRECTIVE ACTIONS:

1. The "Caution" statement in procedure 2OM-52.4.C will be revised to maintain steam generator levels within their alarm setpoint control bands, and a similar "Caution" statement will be introduced in the Unit 1 procedure, by October 4, 1996.
2. Procedural requirements will be established for both units to isolate blowdown at 5% power to help steam generators attain an isothermal temperature prior to reactor shutdown, by October 4, 1996. Blowdown can be subsequently placed in service, below the point of adding heat, if temperature can be adequately controlled.
3. The turbine pedestal test procedures will be revised for both units to only require testing of the overspeed trip at 1800 RPM, with the other tests being performed during turbine coastdown, or on the turning gear, by October 4, 1996.
4. Procedural requirements will be established for both units to continuously monitor for a closure of the last steam dump valve below 5% power, by October 4, 1996. Under normal conditions, power can be held at this point until the valve re-opens, indicating that the steam generators have reached an isothermal condition, and provide the crew with an earlier warning for detecting /correcting feedwater leakage or steam header leakage.
5. Procedural requirements will be established for both units for the bypass feedwater regulating valve block valve (to the affected steam generator) to be closed, if the narrow range steam generator level reaches 45%, by October 4, 1996.
6. Procedural requirements will be established for both units to monitor power range indications and loop delta-T's below 5% power, by October 4, 1996. These will include instructions for isolating the Main Steam Isolation Valve (MSIV) and main steam line drains of the affected steam generator if T_{ave} cannot be maintained.
7. The above changes were validated for both units on the simulator by September 16, 1996.
8. Leakage through the bypass feedwater regulating valve will be monitored and evaluated during the upcoming startup, since leakage and "AIRCET" (air operated valve actuator testing and analysis) testing subsequent to this event, performed under cold conditions, did not confirm the existence of excessive leakage.

SAFETY IMPLICATIONS:

There were minimal implications to the health and safety of the public due to this event. Safety systems functioned as designed. Plant parameters were restored to normal in accordance with plant procedures.

MANUFACTURER DATA:

Bypass Feedwater Regulating Valve 2FWS-FCV479: Masoneilan International (M120) globe valve, Model 41037.

PREVIOUS SIMILAR EVENTS:

During the past two years, the following similar event has occurred:

LER 1-96-003-01, "ESF Actuation - Feedwater Isolation Due to Steam Generator Water Level Transient."