FirstEnergy

Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, Ohio 43449-9760

NP-33-00-003-00

Docket No. 50-346

License No. NPF-3

May 11, 2000

United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Ladies and Gentlemen:

LER 2000-003
Davis-Besse Nuclear Power Station, Unit No. 1
Date of Occurrence – April 12, 2000

Enclosed please find Licensee Event Report 2000-003, which is being submitted to provide 30 days written notification of the subject occurrence. This LER is being submitted in accordance with 10CFR50.73(a)(2)(i)(B).

Very truly yours,

James H. Lash
Plant Manager
Davis-Besse Nuclear Power Station

DLM/dlc

Enclosure

cc: Mr. James E. Dyer, Regional Administrator, USNRC Region III

Mr. Kevin S. Zellers, DB-1 NRC Senior Resident Inspector

Utility Radiological Safety Board

IE22

COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station in this document. Any other actions discussed in the submittal represent intended or planned actions by Davis-Besse. They are described only as information and are not regulatory commitments. Please notify the Manager – Regulatory Affairs (419-321-8466) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
Further evaluation of check valves MS145 and MS146 will be performed to determine if a different design check valve is more appropriate in this application.	Prior to the Thirteenth Refueling Outage

NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50.0 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), 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. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Davis-Besse Unit Number 1	05000346	1 OF 6

TITLE (4)
Loss of Auxiliary Feedwater Pump Turbine Main Steam Supply Train Separation Due to Check Valve Failure

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	DOCKET NUMBER
04	12	2000	2000	-- 003 --	00	05	11	2000	FACILITY NAME	05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	6
POWER LEVEL (10)	000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR : (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
D. L. Miller, Senior Engineer - Licensing	(419) 321-7264

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (if yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 12, 2000, at 0115 hours, with the Davis-Besse Nuclear Power Station in Refueling Mode 6, a Condition Report was initiated that identified that two check valves in the main steam supply to the Auxiliary Feedwater Pump Turbines (AFPT) had failed reverse flow testing. The two check valves that failed, AFPT 1 Main Steam Minimum Flow Line Check Valve (MS145) and AFPT 2 Main Steam Minimum Flow Line Check Valve (MS146), provide train separation between the two AFPT steam supplies. Simultaneous failure of these check valves due to abnormal wear resulted in loss of train separation between the steam line break detection pressure switches for each AFPT. Failure of these valves is a high-energy line break concern but has no impact on the operability of the Auxiliary Feedwater System. These valves were installed with a modification performed during the previous refueling outage. The apparent cause of occurrence is misapplication of the check valves due to the original design being inadequate. Due to the as found condition of the valves, it was concluded that the steam line break pressure switches were inoperable and potentially incapable of detecting a steam line break. This condition existed for a time period longer than allowed by the required Action for Technical Specification (TS) 3.7.1.2 and is reportable as operation prohibited by the plant's TSs in accordance with 10CFR50.73(a)(2)(i)(B).

Description of Occurrence:

On April 12, 2000, at 0115 hours, with the Davis-Besse Nuclear Power Station (DBNPS) in Refueling Mode 6, Condition Report (CR) 2000-0906 was initiated which identified that two check valves in the main steam supply to the Auxiliary Feedwater Pump Turbines (AFPT) [BA-TRB] had failed reverse flow testing. The two check valves that failed testing are designated MS145, AFPT 1 Main Steam Minimum Flow Line Check Valve [V], and MS146, AFPT 2 Main Steam Minimum Flow Line Check Valve [V]. Simultaneous failure of these two check valves resulted in loss of train separation between the AFPT steam line break detection pressure switches.

The two safety-related AFPTs at the DBNPS are driven by steam supplied from the steam generators [SB-SG], which is tapped off the main steam line just after the main steam pipe exits the Containment Shield Building [NH]. The steam supply is split after the main steam line tap and routed so that main steam from each steam generator is capable of being supplied to either AFPT. Each of the steam supply lines contains a motor operated isolation valve (MS106, MS106A, MS107, MS107A) [SB-ISV] and a check valve (MS726, MS734, MS727, MS735, respectively) [V] downstream of the motor operated isolation valve. The six-inch steam lines to the AFPTs are pressurized by the Main Steam System up to the AFPT steam admission valve [BA-FCV], which is located in the respective Auxiliary Feedwater Pump (AFP) room. The purpose of the check valves (MS726, MS734, MS727, MS735) is to prevent back flow of steam to a ruptured steam generator in the event of a single failure that prevents the affected steam generator isolation valve from closing. During normal operation in Modes 1 through 4, the isolation valve from Steam Generator 1 to AFPT 2 (MS107A) is open, which pressurizes the piping to the AFPT 2 steam admission valve. In this flow path, check valve MS735 is subjected to a small steam flow to keep the steam line pressurized and warm, as a small portion of the steam condenses due to thermal losses to ambient. Similarly, the isolation valve from Steam Generator 2 to AFPT 1 (MS106A) is open to pressurize the piping to AFPT 1. This flow path contains check valve MS734, which is subjected to a similar steam flow as MS735. Due to the small steam flow through the check valves MS734 and MS735, these valves were experiencing disc tapping. Disc tapping is frequent opening and closing of the check valve accompanied by the valve producing an audible tap as the valve closes. Disc tapping results in premature wear of the valve disc and seat.

Prior to the eleventh refueling outage (11RFO), a steam trap bypass line was maintained in a throttled position to provide enough steam flow to lift check valves MS734 and MS735 slightly off their seat with the objective of eliminating disc tapping. During 11RFO, Modification 95-0060 installed new piping to capture the steam flow being used to reduce the disc tapping occurring in check valves MS734 and MS735, and routed the steam to a high pressure feedwater heater (E6-2) to improve steam cycle efficiency. As part of the new flowpath, check valves MS145 and MS146 were installed to provide train

Description of Occurrence: (Continued)

separation between the two AFPT steam supplies and the steam line break detection pressure switches. Downstream of MS145 and MS146, the piping was combined to provide a common flowpath to the high pressure feedwater heater. The safety evaluation for the modification concluded that the AFW system is capable of operating from full main steam system pressure all the way to Decay Heat Removal System initiation temperature during a postulated rupture of the new 1½-inch line in the turbine building. Therefore, a failure of check valves MS145 and MS146 would have no adverse affect on the operation of the AFPTs. This is supported by the Technical Specification Bases section 3/4.7.1.2, which states the Operability of the AFPT inlet steam pressure interlocks is required only for high energy line break concerns and does not affect Auxiliary Feedwater System operability.

Updated Safety Analysis Report Section 3.6.2.7.1.5 describes the function of the AFPT Inlet Steam Pressure Switch Low (PSL)Interlocks (PSL106A-D and PSL107A-D). These interlocks are to detect breaks in the portion of the pressurized 6-inch AFPT steam piping in the Auxiliary Building between the check valves (MS726, MS727, MS734, MS735) and the sensor location upstream of the steam admission valves (MS5889A, MS5889B). Upon a low-pressure signal from any set pair of pressure switches, a signal is sent to automatically close the AFPT isolation valves for the appropriate AFPT. The closure of the isolation valves would terminate the steam blowdown in the Auxiliary Building and mitigate the consequences of the harsh environment caused by the break.

The safety evaluation performed for Modification 95-0060 states that check valves MS145 and MS146 are installed to prevent diversion of steam from the intact AFPT train to the ruptured train for the analyzed steam line breaks. The check valves also ensure that the pressure switches (PSL106A-D and PSL107A-D) are not influenced by the intact train. In order to meet the Technical Specification operating requirements for these switches, their setpoints are set low enough (approximately 16 psig) to prevent isolation of the 6-inch AFPT steam supply piping to the AFPTs during plant cooldown with the Auxiliary Feedwater System. A break of the 6-inch AFPT supply line should be detected by the inlet steam pressure interlocks and isolated. These interlocks are required to be operable in accordance with Technical Specification 3.7.1.2. Reverse flow testing of MS145 and MS146 was specified within the safety evaluation for the modification.

The worst-case AFPT steam line break is a break farthest away from the inlet steam pressure interlocks, or just downstream of the isolation valves (MS106, 106A, 107, or 107A) and the supply line check valves (MS726, 727, 734, or 735). If check valve MS145 or MS146 was unable to prevent reverse flow, the break would continue to be fed from the common piping of the opposite steam line or from the high pressure feedwater heater. This could potentially keep the piping sufficiently pressurized to prevent detection by the inlet steam

Description of Occurrence: (Continued)

pressure interlock switches.

Any operation or condition prohibited by the plant's Technical Specifications must be reported in accordance with 10CFR50.73(a)(2)(i)(B). In accordance with NUREG-1022, Event Reporting Guidelines, it is usually assumed that an equipment failure occurred at the time of its discovery unless there is firm evidence, based on a review of relevant information, to believe that the discrepancy existed previously. Both MS145 and MS146 exhibited such gross leakage in the reverse direction that the actual flowrate through the valves could not be accurately quantified. The magnitude of leakage observed, affecting both valves, leads to the conclusion that both valves have been in a failed condition for an extended period of time. The Action for Technical Specification 3.7.1.2 requires that with any AFPT Inlet Steam Pressure Interlocks inoperable, restore the inoperable interlocks to operable status within 7 days or be in Hot Shutdown within the next 12 hours. Due to the as found tested condition of the valves, it was concluded that the steam line break pressure switches were incapable of detecting a steam line break for a time period longer than allowed by the Technical Specification. The required Action for Technical Specification 3.7.1.2 was not met. Therefore, this condition represents operation prohibited by the plant's Technical Specifications and is being reported in accordance with 10CFR50.73(a)(2)(i)(B).

Apparent Cause of Occurrence:

The apparent cause of occurrence for the failure of check valves MS145 and MS146 is misapplication of the check valves due to the original design in Modification 95-0060 being inadequate.

The design of the minimum flow piping called for throttling the flow through MS145 and MS146 with a downstream globe valve, MS 143 and MS 147 respectively, to the point where valves MS734 and MS735 stopped tapping. Throttling flow was desired to minimize the amount of steam that had to be diverted to the high pressure feedwater heater. Although the flow was throttled to stop MS734 and MS735 from tapping, the flow was not sufficient to maintain check valves MS145 and MS146 fully open. The design package for Modification 95-0060 did not include consideration for determining the minimum required flow rate to maintain check valves MS145 and MS146 in the fully open position. Although required by the valve specification, the minimum flow to hold the disc fully open was not identified on the drawing for the valve. These check valves are bolted cover, piston lift check valves, Velan Figure Number W07-2034B-02AA, with a spring opposing opening of the valve. The size of the spring in the valve did not allow the valve to be fully open with throttled flow. Considering the location of the check valves in the piping, the check valves are subjected to turbulent flow. There was insufficient flow to keep the check valves open against the force of the spring internal to the check valve.

Apparent Cause of Occurrence: (Continued)

Excessive cycling of the valve in the mid-position of travel led to excessive, unexpected wear which degraded the valves to the point where they eventually stuck in the open position.

Analysis of Occurrence:

The condition being reported has minimal safety significance. The purpose of check valves MS145 and MS146 is to prevent feeding a steam line break from an intact AFPT steam supply line following a steam line break in the opposite train. The Safety Evaluation for the minimum flow line modification concluded that the AFW system is capable of operating from full main steam system pressure all the way to the Decay Heat Removal System initiation temperature during a postulated rupture of the 1½-inch minimum flow line in the turbine building. Therefore, failure of check valves MS145 and MS146 has no adverse affect on the operation of the AFPTs and the ability to provide auxiliary feedwater to the steam generators.

Technical Specification Bases section 3/4.7.1.2, states the Operability of the AFPT inlet steam pressure interlocks is required only for high energy line break concerns. The Updated Safety Analysis Report postulates only one steam line to be ruptured. The check valves are to ensure that the steam line break detection pressure switches (PSL106A-D and PSL107A-D) are not influenced by the intact train. The worst-case AFPT steam line break is a break farthest away from the inlet steam pressure interlocks, or just downstream of the steam supply line check valves (MS726, 727, 734, or 735). If check valves MS145 or MS146 were unable to prevent reverse flow, the break would continue to be fed from the 1½-inch cross-connect line and/or from the high pressure feedwater heater, potentially keeping the piping sufficiently pressurized to prevent detection by the inlet steam pressure interlocks. The flow through check valves MS145 and MS146 is throttled to minimize the steam diverted to the high pressure feedwater heater. Due to the unknown position of the throttle valves upon discovery of this condition, evaluations performed considered worst case steam flow through MS145 and MS146 to the ruptured train. Any reduction of the steam flow, to backfeed a ruptured steam line due to throttling the downstream globe valves, will increase the ability of the pressure switches to detect a steam line break and perform the design function to initiate isolation.

Since the capability of pressure switches PSL106A-D and PSL107A-D to detect breaks is limited to a small section of the supply piping, and a single failure of the isolation valve could prevent isolation of the break, the equipment qualification temperature profiles did not credit the switches. Additional pressure switches (PSL5894A,B and PSL5895A,B), located upstream of the MS106A and MS107A isolation valves, were provided to detect breaks in the steam supply piping and annunciate an alarm in the Control Room. This indication is available to the operator to identify that a steam line break has occurred.

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

Analysis of Occurrence: (continued)

These switches are set at approximately 730 PSIG. Upon receiving a steam generator to AFPT main steam pressure low alarm in the Control Room, the operators would be alerted to a steam line leak and entry into abnormal procedures would be required. The equipment qualification profiles are based on operator action ten minutes after receipt of the alarm.

Corrective Actions:

Prior to Startup from 12RFO, check valves MS145 and MS146 were replaced. Valves identical to those originally installed were used with the exception that a lower force spring was installed in the valve. The spring was sized to keep check valves MS145 and MS146 fully open based on the minimum expected flow. Reverse flow testing of the modified valves was conducted in accordance with DB-PF-03069, Reverse Flow Test, as required by the original design.

Further evaluation of check valves MS145 and MS146 will be performed prior to the thirteenth refueling outage to determine if a different design check valve is more appropriate in this application.

Failure Data:

There have been no LERs within the past three years for the failure of check valves required to provide system train separation that resulted in a failure to satisfy Technical Specifications.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

NP-33-00-003-00 CR 2000-0906