FirstEnergy

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

NP-33-02-0002-00

Docket No. 50-346

License No. NPF-3

April 29, 2002

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

LER 2002-002-00
Davis-Besse Nuclear Power Station, Unit No. 1
Date of Occurrence – 2/27/2002

Ladies and Gentlemen:

Enclosed please find Licensee Event Report 2002-002-00 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)(ii)(A).

Very truly yours,

for J.R. Fast

Randel J. Fast
Plant Manager
Davis-Besse Nuclear Power Station

RMC/dlc

Enclosure

cc: Mr. J. E. Dyer, Regional Administrator, USNRC Region III
Mr. C. S. Thomas, 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 (DBNPS) in this document. Any other actions discussed in the submittal represent intended or planned actions the DBNPS. They are described only for information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs (419-321-8450) at the DBNPS of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
The CRDM nozzles with axial flaws through the J-groove weld, as well as two other CRDM nozzle discovered with axial flaws that did not penetrate the J-groove weld (i.e., CRDM nozzles #5 and #47, (locations K7 and D12, respectively)), will be repaired prior to the DBNPS return to service following the 13th RFO.	End of 13RFO
The RPV head degraded area will be repaired prior to the DBNPS return to service following the 13th RFO.	End of 13RFO
A self-assessment of the Boric Acid Corrosion Control Program and Inservice Inspection Program will be performed to evaluate and correct the deficiencies documented by the Root Cause team.	July 1, 2002

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

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.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Davis-Besse Unit Number 1	05000346	1 OF 5

TITLE (4)

Reactor Coolant System Pressure Boundary Leakage Due to Primary Water Stress Corrosion Cracking of Control Rod Drive Mechanism Nozzles and Reactor Pressure Vessel Head Degradation

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
02	27	2002	2002	-- 002 --	00	04	29	2002		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	6
POWER LEVEL (10)	0

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)	X	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)
R.M. Cook, Engineer - Compliance	(419) 321-7782

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
X	AB	RPV	B&W	Y					
X	AB	NZL	B&W	N					

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 February 27, 2002, at 1330 hours, ultrasonic (UT) examination of the Control Rod Drive Mechanism (CRDM) nozzles revealed axial indications in the J-groove weld and Alloy 600 nozzle resulting in pressure boundary leakage for CRDM nozzle #3. This was reported within 8 hours, at 1542 hours, as a non-emergency condition in accordance with 10 CFR 50.72(b)(3)(ii)(A). On March 5, 2002, a follow-up notification was made to report completion of the UT examinations and through pressure boundary axial indications in the Alloy 600 nozzles at CRDM nozzles # 1 and #2. On March 8, 2002, a further notification was made in accordance with 10 CFR 50.72(b)(3)(ii)(A) to report degradation of the Reactor Pressure Vessel (RPV) head. These events are being reported in accordance with 10CFR50.73(a)(2)(ii)(A) as a condition that resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded and 10CFR50.73(a)(2)(i)(B) as a condition prohibited by the plant's Technical Specifications. The apparent cause of the axial flaws resulting in pressure boundary leakage was determined to be Primary Water Stress Corrosion Cracking (PWSCC). The root cause of the RPV head condition is boric acid corrosion resulting from moisture introduced due to PWSCC cracking of CRDM nozzle #3. The CRDM nozzles and the RPV head will be repaired prior to returning the DBNPS to service from the current refueling outage. Industry and NRC assessments have previously concluded that axial flaws do not present an immediate safety concern. Therefore, the discovery of these flaws alone has minimal safety significance. The as-found condition of the RPV head was assessed and would have functioned to maintain the RPV head structural integrity during anticipated operational occurrences and postulated accidents.

Description of Occurrence:

On February 16, 2002, the Davis-Besse Nuclear Power Station (DBNPS) began its thirteenth refueling outage (RFO) that included inspection of the Reactor Pressure Vessel [RPV] head Control Rod Drive Mechanism (CRDM) nozzles [NZL] in accordance with NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles." These inspections were conducted to determine if Primary Water Stress Corrosion Cracking (PWSCC) had occurred that could have caused CRDM nozzle cracking in a circumferential direction (i.e., around the circumference of the nozzle). The inspections consisted of a 100% qualified visual inspection of the RPV head at the CRDM nozzle penetration annulus area and 100% ultrasonic (UT) examination of each of the 69 CRDM nozzles. The qualified visual inspection was inconclusive because of the large amount of boric acid crystal deposits on the RPV head. Subsequent bottom-up blade probe UT examination identified outside diameter (OD) initiated axial flaw indications in the Alloy 600 nozzle for CRDM nozzle #3, which is located near the center of the RPV head (location G-9). On February 27, 2002, at 1330 hours, evaluation of the indications on nozzle #3 identified a path for Reactor Coolant System (RCS) [AB] pressure boundary leakage. Technical Specification 3.4.6.2 states the RCS leakage shall be limited to no pressure boundary leakage. This was reported within 8 hours, at 1542 hours, via the Emergency Notification System (ENS) as a non-emergency condition in accordance with 10 CFR 50.72(b)(3)(ii)(A), a condition that resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded. Examination by the UT method later identified pressure boundary leakage indications on CRDM nozzles #1 (location H-8) and #2 (location G-7). In addition, a circumferential flaw indication was identified above the J-groove weld on the OD of CRDM nozzle #2. The circumferential indication on this CRDM nozzle was 34 degrees in length but had not penetrated the nozzle thickness (i.e., approximately 50% through-wall). These indications were confirmed by top-down rotating probe UT examination. The final UT examination results were provided to the NRC via the ENS in an update to the original notification report on March 5, 2002, at 1921 hours.

The following table summarizes and characterizes the number of flaws identified during the UT examinations for the three CRDM nozzles:

NOZZLE	AXIAL (through wall)	AXIAL (not through wall)	CIRCUMFERENTIAL (not through wall)
1	2	7	
2	6	2	1
3	2	2	

While machining CDRM nozzle # 3 during repair activities, the CRDM nozzle exhibited unexpected movement. To identify the cause of the CRDM nozzle movement, an investigation into the condition of the RPV head surrounding CRDM nozzle #3 was initiated. This investigation included removing the CRDM nozzle from the RPV head and removing boric acid deposits from the top of the RPV head. Upon completing the boric acid removal, a visual examination of the area was conducted which identified a cavity in the RPV head adjacent to CRDM nozzle #3. This condition was reported to the NRC via the

Description of Occurrence: (continued)

ENS on March 8, 2002, in accordance with 10CFR 50.72(b)(3)(ii)(A) as a condition that resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded. Ultrasonic thickness measurements of the RPV head in the vicinity of CRDM nozzles #1, #2, and #3 were performed. Follow-up characterization by UT examination indicated degradation of the low alloy steel RPV head material adjacent to the CRDM nozzle. The degraded area was found to extend approximately 6.6 inches from the penetration for CRDM nozzle #3, with a width of approximately 4 to 5 inches at its widest part. The remaining thickness of the RPV head in the degraded area was found to be an average of approximately 0.30 inches. These events are being reported in accordance with 10CFR50.73(a)(2)(ii)(A) as a condition that resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded and 10CFR50.73(a)(2)(i)(B) as a condition prohibited by the plant's Technical Specifications.

The investigation also showed a small area of corrosion where CRDM nozzle #2 penetrated the RPV top head surface. The small area of corrosion at the top of nozzle 2 was found to lie directly over the area of corrosion inside the penetration for CRDM nozzle #2. The investigation also showed evidence of a small leak path where CRDM nozzle #1 penetrated the RPV top head surface. These issues are not reportable, but are included herein for information. Further discussion of these CRDM nozzles is provided in the root cause report, "Significant Degradation of the Reactor Pressure Vessel Head", as was submitted to the NRC on April 18, 2002 (DBNPS Serial Letter Number 1-1270).

Apparent Cause of Occurrence:

On March 8, 2002, the DBNPS management assembled a group of FirstEnergy Nuclear Operating Company personnel and industry experts to investigate the RPV head and CRDM nozzle condition to determine the root cause. This effort determined that:

- The probable cause of the axial through-wall flaws was PWSCC in the CRDM nozzles due to material susceptibility in the presence of a suitable environment. This is consistent with previous industry experience with PWSCC in Alloy 600 components as was evaluated as part of the NRC Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Closure Head Penetrations."

- The root cause of the degradation of the RPV head is boric acid corrosion resulting from CRDM nozzle leakage over a significant period of time, and its lack of discovery due to inadequate Boric Acid Corrosion Control Program and Inservice Inspection Program implementation regarding the RPV head. The inadequate implementation of the Boric Acid Corrosion Control Program resulted in the leakage from the CRDM nozzle annulus areas not being identified during plant outages, allowed the plant to return to power with boric acid crystal deposits on the RPV head following the plant outages, and not identifying the degradation of the RPV head base metal during the twelfth

- Apparent Cause of Occurrence: (continued)

- RFO in 2000. The root cause report, "Significant Degradation of the Reactor Pressure Vessel Head" was submitted to the NRC on April 18, 2002 (DBNPS letter Serial Number 1-1270).

Analysis of Occurrence:

The average total unidentified leakage from the Reactor Coolant System on February 15, 2002 at the end of the 13th operating cycle was approximately 0.20 gallons per minute (gpm). This is less than the 1 gpm limit permitted by Technical Specification 3.4.6.2. Axial flaws of the type discovered in CRDM nozzles #1, #2, and #3 have been evaluated by the industry and the NRC to not be an immediate safety concern. This evaluation is documented in NRC Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Closure Head Penetrations." However, this significance assessment is dependent and reliant on effective inspection and detection of leakage from the CRDM nozzle penetration annulus area in a timely manner. The lack of timeliness in the discovery of the leakage from the CRDM nozzle penetration annulus areas resulted in degradation of the low-alloy carbon steel RPV head.

A safety significance assessment of the degraded RPV head was submitted to the NRC on April 8, 2002 (DBNPS letter Serial Number 1-1268). This submittal provided a detailed assessment for the degradation of the RPV head. This evaluation determined that in its degraded condition, structural integrity would have been maintained, based on an average clad thickness of 0.297 inches over a conservative area of degradation, to approximately 5600 pounds per square inch. Evaluation of the minimum clad thickness of 0.24 inches over the conservative area of degradation resulted in structural integrity being maintained to approximately 4600 pounds per square inch. Thus, the as-found RPV head would have functioned to maintain structural integrity during anticipated operational occurrences and postulated accidents.

A deterministic safety assessment was performed and concluded that in the unlikely event of RPV head failure considering the as-found degraded condition: a) adequate core cooling could have been established and maintained for the long term, b) the reactor could have been placed and maintained in a safe shutdown condition, and c) the integrity of the containment would not have been compromised. In addition, a probabilistic safety assessment concluded, per Regulatory Guide 1.174 guidelines, that there was a small increase in core damage frequency and a very small increase in large early release frequency.

Corrective Actions:

An extent of condition walkdown and inspection of the RCS and structures, systems and components inside of containment is being performed during the current refueling outage to evaluate if boric acid leakage or corrosion in susceptible systems may be occurring.

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Davis-Besse Unit Number 1	05000346	2002	-- 002 --	00	5 OF 5

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

Corrective Actions: (continued)

The CRDM nozzles #1, #2, and #3 with pressure boundary leakage, as well as CRDM nozzles #5 (location K-7) and CRDM nozzle #47 (location D-12) discovered with axial flaws that did not penetrate the J-groove weld (i.e. not pressure boundary leakage) and the RPV head degraded area will be repaired prior to the DBNPS return to service following the 13th RFO.

A self-assessment of the Boric Acid Corrosion Control Program and Inservice Inspection Program will be performed to evaluate and correct the deficiencies documented in DBNPS letter Serial Number 1-1270. This activity will be completed by July 1, 2002.

Other contributing causes for this event have been identified in the root cause report, "Significant Degradation of the Reactor Pressure Vessel Head" (DBNPS letter Serial Number 1-1270). The resolution of these issues is being administered in accordance with the requirements of Confirmatory Action Letter Number 3-02-001, dated March 13, 2002.

Failure Data:

There have been no previous occurrences of through-wall axial flaws on CRDM nozzles or RPV head degradation at the DBNPS.

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

NP-33-02-002-00

CR 2002-00891
CR 2002-00932
CR 2002-01053
CR 2002-01128