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NP-33-03-009-00

Docket No. 50-346

License No. NPF-3

October 13, 2003

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

Ladies and Gentlemen:

LER 2003-009  
Davis-Besse Nuclear Power Station, Unit No. 1  
Date of Occurrence – August 14, 2003

Enclosed please find Licensee Event Report (LER) 2003-009, which is being submitted to provide written notification of the loss of offsite power that occurred due to degraded regional grid voltage. This LER is being submitted in accordance with 10CFR50.73(a)(2)(iii), 10CFR50.73(a)(2)(iv) and 10CFR50.73(a)(2)(v). No commitments are associated with this LER.

Very truly yours,



GMW/s

Attachments

cc: Regional Administrator, USNRC Region III  
DB-1 NRC Senior Resident Inspector  
DB-1 Senior Project Manager, USNRC  
Utility Radiological Safety Board

IE22

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**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 (419-321-8450) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

**COMMITMENTS**

**DUE DATE**

None

N/A

NRC FORM 366 (7-2001)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB NO. 3150-0104			EXPIRES 7-31-2004		
<b>LICENSEE EVENT REPORT (LER)</b>										
(See reverse for required number of digits/characters for each block)										
1. FACILITY NAME Davis-Besse Unit Number 1				2. DOCKET NUMBER 05000346				3. PAGE 1 OF 6		
4. TITLE Loss Of Offsite Power due to Degraded Regional Grid Voltage										
5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	14	2003	2003	009	00	10	13	2003	FACILITY NAME	DOCKET NUMBER
9. OPERATING MODE		5		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)						
10. POWER LEVEL		000		20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
				20.2201(d)		20.2203(a)(4)		X 50.73(a)(2)(iii)		50.73(a)(2)(x)
				20.2203(a)(1)		50.36(c)(1)(i)(A)		X 50.73(a)(2)(iv)(A)		73.71(a)(4)
				20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		X 50.73(a)(2)(v)(A)		73.71(a)(5)
				20.2203(a)(2)(ii)		50.36(c)(2)		X 50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
				20.2203(a)(2)(iii)		50.46(a)(3)(ii)		X 50.73(a)(2)(v)(C)		
				20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		X 50.73(a)(2)(v)(D)		
				20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
				20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
				20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		
12. LICENSEE CONTACT FOR THIS LER										
NAME Gerald M. Wolf, Staff Engineer - Licensing							TELEPHONE NUMBER (Include Area Code) (419) 321-8001			
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT										
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	
14. SUPPLEMENTAL REPORT EXPECTED							15. EXPECTED SUBMISSION DATE			
YES (If yes, complete EXPECTED SUBMISSION DATE).				X	No		MONTH	DAY	YEAR	
16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)										
<p>On August 14, 2003, with the plant shutdown in Mode 5, degraded grid voltage conditions were experienced. At 1608 hours, grid voltage degraded to the point where the under voltage relays actuated to disconnect the essential buses from the normal power source, which resulted in a start of the Emergency Diesel Generators (EDGs). The EDGs re-energized the essential buses, and Decay Heat Cooling to the Reactor Core was manually restarted per procedure. An Unusual Event was declared at 1621 hours due to the loss of offsite power, and the Emergency Response Organization was activated to assist with plant recovery. The on-site electrical distribution system was re-energized in an orderly and controlled manner, and plant equipment was restarted as power was available, including restoration of Spent Fuel Pool cooling. A pressure transient was experienced in the Service Water System due to the stopping and automatic re-starting of the Service Water Pumps, which caused a gasket leak on a Component Cooling Water Heat Exchanger and distortion of Containment Air Coolers expansion bellows. This event is being reported in accordance with 10CFR50.73(a)(2)(iv) as a valid actuation of the EDGs, in accordance with 10CFR50.73(a)(2)(v) as a condition that could have prevented the fulfillment of a safety function, and in accordance with 10CFR50.73(a)(2)(iii) as an external condition that posed a threat to the safety of the plant.</p>										

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		2003	-- 009 --	00	

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

DESCRIPTION OF OCCURRENCE:

On August 14, 2003, the Davis-Besse Nuclear Power Station (DBNPS) was in Mode 5 with the equipment hatch installed. Train 2 of the Decay Heat System [BP] was providing core cooling, and a planned Reactor Coolant System [AB] drain was in progress to perform maintenance activities.

At approximately 1516 hours (EDT), a low voltage alarm of 329 kV was received on the DBNPS Switchyard 345 kV Bus J [FK]. This and other low voltage alarms on 345 kV Bus K and 4160 V Essential Buses C1 and D1 [EA] actuated and cleared several times until 1606 hours, when the 345 kV Bus voltages experienced a step drop to 308 kV. The 4160 V Essential Bus voltages dropped to 3870 V, and low voltage alarms were received on the following buses:

- 13.8 kV Buses A and B
- 4160 V Essential Buses C1 and D1
- 4160 V Non-Essential Buses C2 and D2 [EB],
- 480 V Essential Buses E1 and F1 [EC]
- 480 V Non-Essential Buses E2, E3, E6, F2, and F7 [ED].

The 345 kV Bus voltages continued to slowly lower from 308 kV to 300 kV with a corresponding lowering of 4160 V Bus voltage until at 1608 hours the 90 percent under voltage relay [EB-27] of the Safety Features Actuation System (SFAS) [JE] on 4160 V Essential Bus D1 actuated. This relay disconnected essential Bus D1 from non-essential Bus D2, and the 59 percent loss of voltage relay actuated to automatically fast start Emergency Diesel Generator (EDG) 2 [EK-DG]. EDG 2 re-energized Bus D1, and subsequently Service Water Pump 2 [BI-P] and Component Cooling Water (CCW) Pump 2 [CC-P] automatically restarted to supply cooling to EDG 2. Approximately 40 seconds later, the 90 percent under voltage relay on 4160 V Essential Bus C1 similarly actuated on the lowering voltage, which resulted in a start of EDG 1 along with Service Water Pump 1 and CCW Pump 1.

All DBNPS Switchyard breakers remained closed during the event since no fault was sensed that would have initiated a trip/open signal. However, the low-side breakers [EA-52] for the two Startup Transformers [EA-XFMR] opened on under frequency to isolate the 13.8 kV Buses A and B from the 345 kV distribution network.

As a result of the loss of offsite power, an Unusual Event was declared at 1621 hours based on Emergency Action Level (EAL) 4.A.1. The Emergency Response Organization was activated to assist with plant recovery. Outage-related work was halted during the Unusual Event including the ongoing drain of the Reactor Coolant System. Electrical bus restoration was performed in an orderly and controlled manner, and the majority of the on-site electrical distribution system was re-energized by 0300 hours on August 15, 2003. Following the restoration, EDG 1 was unloaded and shutdown at 0617 hours, and EDG 2 was unloaded and shutdown at 1425 hours on August 15, 2003.

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

## DESCRIPTION OF OCCURRENCE: (Continued)

The loss of offsite power resulted in loss of power to the operating Decay Heat Pump (Pump 2). At 1641 hours, Decay Heat Pump 2 was manually restarted in accordance with the Loss of Decay Heat Removal Abnormal Operating Procedure.

During the loss of offsite power, a Service Water System leak of approximately 4-5 gallons per minute was discovered on the end bell of CCW Heat Exchanger 3 [CC-HX]. The Service Water inlet and outlet isolation valves for the heat exchanger were closed to isolate the leak.

The loss of offsite power also resulted in loss of power to the non-essential Spent Fuel Pool Cooling System [DA]. At 0253 hours on August 15, 2003, following offsite power restoration, Spent Fuel Pool Cooling was returned to service.

The Unusual Event was terminated at approximately 1920 hours on August 15, 2003.

Following the event, a walkdown of Containment identified that the expansion bellows [BK-EXJ] in the Containment Air Cooler (CAC) Service Water return piping were distorted. These expansion bellows had been installed during the current plant outage as part of the re-design of the CAC piping to reduce the thermal loading of the cooling coil nozzles. Refer to DBNPS LER 2002-008 for further information on the replacement of the CACs.

The declaration of an Emergency Classification (Unusual Event) is reportable per 10CFR50.72(a)(1)(i) and 10CFR50.72(a)(3) within one hour of the declaration. Notification to the NRC was completed at 1654 hours on August 14, 2003 (Event Notification Number 40070).

This event resulted in a valid actuation of the Emergency AC electrical power system; therefore, it is being reported in accordance with 10CFR50.73(a)(2)(iv) as an actuation of a specified system.

In accordance with the guidance contained in NUREG-1022, Event Reporting Guidelines, the offsite power and the onsite emergency power systems are considered to have separate safety functions by 10CFR50 Appendix A Criterion 17 (General Design Criteria or GDC 17). The safety function of each of these systems is to provide sufficient capacity and capability, etc., assuming that the other system is not available. A loss of either system results in a loss of the safety function of that system. Therefore, this event involving the loss of offsite power is also being reported in accordance with 10CFR50.73(a)(2)(v) as an event or condition that could have prevented the fulfillment of a safety function. Because the loss of safety function was due to an external condition, this event is also being reported in accordance with 10CFR50.73(a)(2)(iii) as an external condition that posed a threat to the safety of the nuclear power plant.

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APPARENT CAUSE OF OCCURRENCE:

The events that led to the degraded grid voltage conditions in several Eastern and Midwestern states as well as Canada were outside the control and responsibility of the DBNPS. An international commission is currently investigating the cause for the degraded grid voltage conditions.

The distortion of the CAC Service Water piping expansion bellows was the result of an inadequate hydrodynamic transient analysis. The analysis used to design the CAC Service Water piping under-predicted the peak pressures that would occur for a loss of offsite power condition, when the Service Water Pump Motors would be de-energized and would subsequently restart in approximately 30 to 50 seconds, in conjunction with low Service Water System flow/high Service Water System pressure that would exist with the plant in a shutdown condition. Non-conservative hydrodynamic transient model parameters used in the analysis included Service Water System pressure, lake level, pump start times, valve alignments, and residual void volume.

The Service Water System leakage from the end bell of CCW Heat Exchanger 3 was caused by inadequate thickness dimension of the gasket material installed during the current outage. The gasket material was unable to accommodate the irregularities that existed in the gasket sealing surfaces. The inadequate gasket thickness had been identified prior to the loss of offsite power event but had not yet been repaired. The leak manifested itself because of the anticipated hydrodynamic transient that occurred as a result of the loss of power to the operating Service Water Pumps.

ANALYSIS OF OCCURRENCE:

Because the DBNPS has been in an extended shutdown, the decay heat output of the Reactor Core is very low. As a result, during the approximately 30 minutes Decay Heat Pump 2 was not operating due to the loss of offsite power, the temperature of the Reactor Coolant System only increased approximately one degree Fahrenheit.

The Spent Fuel Pool Cooling System was not operating for approximately 11 hours as a result of the loss of offsite power. As a result of the system's unavailability, the temperature of the Spent Fuel Pool only increased approximately 9 degrees Fahrenheit (from an average of approximately 92.7 degrees prior to the event to a maximum of 101.7 degrees). Decay Heat Pump 1 remained available to provide cooling to the Spent Fuel Pool during the time the Spent Fuel Pool Cooling System was not available.

Because of the loss of offsite power, the Service Water Pump Motors were de-energized and subsequently restarted when the EDGs restored power to the 4160V Essential Busses. This temporary loss of Service Water resulted in an anticipated hydrodynamic transient (water hammer). However, because the analysis performed to design the CAC Service Water piping underestimated the peak pressures and resultant piping forces from a loss and restoration of the

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## ANALYSIS OF OCCURRENCE: (Continued)

Service Water System with the plant in shutdown conditions, distortion and misalignment of the CAC expansion bellows occurred. Because the discharge isolation valve for CAC 1 was closed at the time of the loss of offsite power, the peak pressure experienced was significantly higher as compared to CAC 2 and CAC 3, and the expansion bellows for CAC 1 experienced a greater degree of distortion. The discharge isolation valve for CAC 3 was also closed at the time of the event, but with the supply to CAC 3 aligned to the supply of CAC 2, the open discharge isolation valve for CAC 2 reduced the magnitude of the hydrodynamic transient.

None of the expansion bellows on any of the three CACs leaked as a result of the hydrodynamic transient. Though not required to be operable with the plant in a shutdown condition, CAC 1 was declared inoperable as a result of the expansion bellows distortion. The distortion of the expansion bellows of CAC 2 and 3 did not render them incapable of performing their designated safety functions. Visual inspections were performed for the remainder of the Service Water System addressed by the Technical Specifications to ensure other equipment had not been damaged by the hydrodynamic transient, and no other damage or distortion was noted.

The leakage from the end bell of CCW Heat Exchanger 3 was not sufficient to have an adverse effect on the operation of either the Service Water or CCW Systems.

All other safety systems performed as designed, including the starting of the EDGs and the loading of the Essential 4160 V Busses. Reactor Coolant System inventory was maintained at approximately 28 feet on the medium-range indication during the loss of offsite power. Based on the equipment response and operator actions during this event, the loss of offsite power had minimal safety significance.

## CORRECTIVE ACTIONS:

Immediate actions taken in response to the loss of offsite power are described in the Description of Occurrence section of this report. No onsite actions to prevent recurrence of the loss of offsite power are identified due to the external nature of the event.

In accordance with the DBNPS Corrective Action Process, the expansion bellows for all three CACs are scheduled to be replaced prior to reactor startup. Additional design and configuration changes will also be implemented to assure the CACs remain operable following anticipated hydrodynamic transients.

An appropriately sized gasket was installed on CCW Heat Exchanger 3 on August 21, 2003.

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

FAILURE DATA:

LER 2000-004 documented an event that occurred on April 22, 2000, where offsite power was lost while conducting bus transfer testing during a refueling outage. The corrective actions from this 2000 event, which was a result of personnel error, could not have prevented this current event, which was caused by external events outside the control and responsibility of the DBNPS.

LER 1998-006 documented an event that occurred on June 24, 1998, where a complete loss of offsite power occurred due to the DBNPS switchyard being damaged from a tornado and accompanying straight-line winds, rain and lightning. Corrective actions were not feasible to prevent a loss of offsite power due to external events of this nature.

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

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CRB 03-06590, 03-06597, 03-06651