

NP-33-98-006

Docket Number 50-346

License Number NPF-3

August 21, 1998

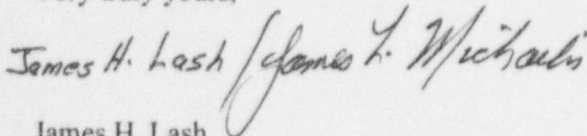
United States Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Ladies and Gentlemen:

LER 1998-006  
Davis-Besse Nuclear Power Station, Unit No. 1  
Date of Occurrence - June 24, 1998

Enclosed please find Licensee Event Report 1998-006, which is being submitted written notification of the subject occurrence. This LER is being submitted in accordance with 10CFR50.73(a)(2)(i), 50.73(a)(2)(iii), 50.73(a)(2)(iv) and 50.73(a)(2)(v).

Very truly yours,

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

CAK/dlc

Enclosure

cc: Mr. A. B. Beach  
Regional Administrator  
USNRC Region IIIMr. Stephen J. Campbell  
DB-1 NRC Senior Resident Inspector

Utility Radiological Safety Board

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## LICENSEE EVENT REPORT (LER)

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digits/characters for each block)

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 Information and 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 a document used to impose an information collection does not display a current 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)

Davis-Besse Unit Number 1

DOCKET NUMBER (2)

05000346

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TITLE (4)

Tornado Damage to Switchyard Causing Loss of Offsite Power

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
6	24	98	1998	-- 006 --	00	08	21	1998	FACILITY NAME	DOCKET NUMBER	
										05000	
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)											
OPERATING MODE (9)			20.2201(b)			20.2203(a)(2)(v)			X	50.73(a)(2)(i)	50.73(a)(2)(viii)
POWER LEVEL (10)			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)			X	50.73(a)(2)(iii)	73.71
			20.2203(a)(2)(ii)			20.2203(a)(4)			X	50.73(a)(2)(iv)	OTHER
			20.2203(a)(2)(iii)			50.36(c)(1)			X	50.73(a)(2)(v)	Specify in Abstract below
			20.2203(a)(2)(iv)			50.36(c)(2)				50.73(a)(2)(vii)	or in NRC Form 366A

## LICENSEE CONTACT FOR THIS LER (12)

NAME

C. A. Kraemer, Engineer - Licensing

TELEPHONE NUMBER (Include Area Code)

(419) 321-7153

## 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
C	EA	CON		N	X	EK	CDMP		N
X	SB	TD		N	A	EB	52		Y

## SUPPLEMENTAL REPORT EXPECTED (14)

YES

(If yes, complete EXPECTED SUBMISSION DATE)

X NO

EXPECTED  
SUBMISSION  
DATE (15)

MONTH

DAY

YEAR

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

On June 24, 1998, at approximately 2040 hours, with the unit in Mode 1 at 99 percent power, a storm cell moved through the site area, and, at approximately 2044 hours, a tornado touched down onsite. The Emergency Diesel Generators were both manually started when the Control Room received a report of a tornado on site. The damage from the tornado, accompanying straight-linewinds, rain and lightning, resulted in a complete loss of offsite power (LOOP). The LOOP caused the turbine control valves to close in response to a load rejection by the main generator. The Reactor Protection System (RPS) initiated a reactor trip on high Reactor Coolant System (RCS) pressure. At 2118 hours, an Alert was declared in accordance with procedure RA-EP-01500, Emergency Classification, Emergency Action Level (EAL) 8.B.2, Any tornado striking facility. Following restoration of an offsite power source, the Alert was downgraded to an Unusual Event at 0200 hours on June 26, 1998, and at 1405 hours, the Unusual Event was terminated.

The tornado resulted in significant damage to the offsite electrical distribution system, telecommunications, power to the sirens and other unfortified structures. Immediate corrective actions involved the testing and repairing of the affected electrical and mechanical equipment necessary to restore two offsite power sources and assessing damage to other plant components and structures and initiating repairs. Plant telecommunications were restored and the siren system was returned to 90 percent availability prior to plant startup. There were no adverse effects to the public health or safety. Davis-Besse Nuclear Power Station Unit 1 startup was initiated, with reactor criticality reached on July 1, 1998, at 2257 hours, but was shutdown due to elevated sulfate levels in the steam generator water chemistry on July 2, 1998. Following steam generator fill, soak and drains, startup was initiated on July 5, 1998, and at 0400 hours on July 7, 1998, the Main Generator was synchronized to the grid.

### FAILURE CONTINUATION

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

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

## Description of Occurrence:

(Reference Attachment 1, Sequence of Events)

On June 24, 1998, with the unit in Mode 1 at approximately 99 percent power, plant personnel were restoring from the Auxiliary Feedwater Pump 1 (AFP) [Energy Industry Identification System identifier:BA] maintenance outage and were preparing to perform the quarterly AFP Surveillance Test, when at approximately 2040 hours, air circuit breakers [52] in the 345 kilovolt (kV) switchyard opened, potentially due to lightning strikes. Switchyard air circuit breaker (ACB) 34561 opened and breaker ACB 34562 opened and closed several times until it remained open (Reference Attachment 2, Switchyard). At approximately 2044 hours, Security personnel notified the Shift Supervisor that a funnel cloud had been spotted in the vicinity of the Cooling Tower [CTW]. Once notified of the funnel cloud, control room operators commenced starting of the Emergency Diesel Generators (EDGs) [EK DC]. The EDG 2 was started from the Control Room at 2044 hours, but the EDG 1 failed to start from the Control Room. The EDG 1 was successfully started locally at 2046 hours.

At 2047 hours tornado damage to the switchyard resulted in a complete loss of offsite power (LOOP). The damage to the switchyard components and transmission lines caused the Main Generator [EL-GEN] to be disconnected from the distribution grid. This, in turn, initiated a Power Load Unbalance runback of the Turbine [TRB], causing a primary to secondary heat transfer mismatch which caused an increase in Reactor Coolant System (RCS) [AB] pressure, resulting in the Reactor Protection System (RPS) [JC] tripping the reactor on high RCS pressure. The Steam Feedwater Rupture Control System (SFRCS) [JB] actuated the AFP to supply Auxiliary Feedwater to the Once Through Steam Generators (OTSG) [SG]. At this same time, 2047 hours, the Plant Computer System failed because of the loss of power to electrical distribution panel YAU [SWGR].

Personnel accountability was performed and damage assessment ensued. At 2058 hours, it was discovered that the Turbine roof had a large hole (estimated to be 8 feet by 20 feet) and that several turbine roof vents had been ripped off and that rainwater was entering these areas. An Alert was declared at 2118 hours in accordance with procedure RA-EP-01500, Emergency Classification, Emergency Action Level (EAL) 8.B.2, Any tornado striking facility. The Control Room attempted to make the required notifications but it became apparent that there had also been severe damage to the telecommunications system [FI]. Ottawa County was notified at 2124 hours. Contact with Lucas County was made at 2128 hours, but notification was not completed. Attempts were made to notify the State of Ohio, but were unsuccessful. The notification of the State of Ohio was deferred to the Nuclear Regulatory Commission (NRC) during the NRC notification at 2136 hours. There had been a failure of two of the three available telephone systems that service DBNPS (fiber optic and copper lines). Only the microwave system remained operational. Phones not functioning included: the 4-way ring down to state and counties, the NRC Red Phone, and the phones lines connected to the Computerized Automatic Notification System (CANS) which is utilized to call out the Emergency Response Organization (ERO).



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Description of Occurrence: (Continued)

At 2230 hours, the initial switchyard [FK] damage report indicated that there was substantial damage, which included the following (Reference Attachment 2): ABS 34620 had one broken connector [EA-CON], ABS 34621 had two broken connectors, ABS 34622 had one broken connector and ABS 34623, 34624 and 34625 were also damaged. This damage resulted in the loss of all three offsite power sources: Bayshore, Lemoyne and Ohio Edison lines. At 2238 hours, the plant entered Technical Specification (TS) 3.8.1.1 Action d, to restore at least one of the inoperable offsite sources within 24 hours. At this time, the unit was in HOT STANDBY and both EDGs were supplying their essential loads.

The Operations Support Center (OSC) was activated at 2322 hours, the Technical Support Center (TSC) was activated at 2338 hours and the Emergency Control Center (ECC) was activated at 2348 hours.

At 2353 hours with the plant in Mode 3 with RCS pressure at 2265 pounds per square inch gauge (psig) and RCS temperature at 540 degrees Fahrenheit (F), due to the loss of offsite power and the subsequent loss of forced cooling, a natural circulation cooldown was commenced in accordance with procedure DB-OP-06903, Plant Shutdown and Cooldown. The Atmospheric Vent Valves (AVVs) [SB-PCV] were opened by the operators to control steam pressure.

Other equipment anomalies that occurred subsequent to the LOOP and reactor trip included: various meteorological tower [IS] data points were not available and Loop 2 Atmospheric Vent Valve (AVV 2) could not be controlled in automatic.

As part of the area damage assessment, the Prompt Notification System (PNS) sirens were tested. At 0900 hours on June 25, 1998, 26 out of a total of 54 sirens did not respond when polled from the ECC. All of the PNS sirens that did not respond were located in Ottawa County. Ottawa County officials were notified of these results.

At 1035 hours on June 25, 1998, EDG 1 room temperature exceeded 120 degrees F and in accordance with the procedural operating limits EDG 1 was declared inoperable and the plant entered TS 3.0.3. The EDG 1 room ventilation recirculation damper [EK-CDMP] was found to be in the open position. The recirculation damper was placed in the closed position and at 1232 hours, EDG room temperature decreased below 120 degrees F, EDG 1 was declared operable and the plant exited TS 3.0.3.

At 1313 hours, with the recirculation damper closed, the EDG 1 room temperature again increased above 120 degrees F and EDG 1 was again declared inoperable and the plant re-entered TS 3.0.3. Supplemental cooling to EDG 1 was provided by installing portable fans and by opening doors. At 1530 hours, EDG 1 room temperature decreased to 116 degrees F and remained below 120 degrees F while EDG 1 continued to operate until it was shutdown at 2153 hours on June 25, 1998. The EDG 1 remained inoperable pending engineering evaluation, but did continue to run and provide emergency power.

At 1913 hours on June 25, 1998, it was determined that the requirement of TS 3.0.3 to be in hot shutdown within the timeframe specified by the TS could not be met due to procedural restriction on cooldown rate. The Shift Supervisor invoked the provisions of 10CFR50.54(x), emergency departure from technical specifications. The NRC was notified in accordance with 10CFR50.72(b)(1)(i)(B) of this event at 2020 hours.

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Description of Occurrence: (Continued)

At 1926 hours on June 25, 1998, the first offsite source, the Ohio Edison line, was restored. Subsequently, at approximately 2100 hours when Operations attempted to transfer 4.16 kV busses C1/C2 supply from EDG 1 to the BD bus tie transformer [XMFR], ABDC1 [EB-52] failed to close. Operations performed a dead bus transfer of the C2 bus to the AC bus tie transformer via circuit breaker AAC2, then performed a live transfer of C1 to C2 bus via circuit breaker AC110.

On June 25, 1998, at approximately 2330 hours, following the restoration of the Ohio Edison line, EDG 2 shutdown was initiated and D1 bus was energized from X02 transformer. The EDG 2 was unloaded without difficulty. The output breaker AD101 was opened and EDG 2 speed reportedly increased from 900 to 970 revolutions per minute (rpm) due to the Governor Control [65] switching out of Electric Control to Hydraulic Control. Using the local speed changer, the EDG 2 speed was set to 900 rpm; the normal stop button was pressed and the diesel shutdown normally. At this time, 2335 hours on June 25, 1998, EDG 2 was declared inoperable due to an apparent problem with the governor control. At 2335 hours with the Ohio Edison line declared operable, the first TS 3.8.1.1 action d requirement, return one offsite source to operable within 24 hours, was completed. The plant remained in TS 3.0.3 due to two EDGs inoperable and one offsite source inoperable.

At 0200 hours on June 26, 1998, the Emergency Director in accordance with procedure RA-EP-01500 under E.A.L. 9.2, downgraded from an Alert to an Unusual Event. The NRC was notified at 0300 hours.

At 0340 hours on June 26, 1998, EDG 1 was declared operable based on an engineering evaluation and EDG 1 room temperature less than 120 degrees F. The plant exited TS 3.0.3 and entered TS 3.8.1.1 action c, with one offsite circuit and one diesel generator inoperable.

On June 26, 1998, at 1130, the second offsite source (Lemoyne line) was declared operable but the plant remained in TS 3.8.1.1 Action c because EDG 2 was still inoperable.

At 1240 with Station Vent Radiation Element RE 4598 AA [IL-45] out of service for calibration, Station Vent RE 4598 BA was declared inoperable due to water intrusion causing intermittent spiking. The CREVS was manually initiated. The plant entered TS 3.0.3 and commenced cooldown at 1332 hours. The NRC was notified at 1405 hours of the TS 3.0.3 entry due to radiation monitor inoperability and the loss of safety function in accordance with 10CFR50.12(b)(2)(ii).

During this notification at 1405 hours, the NRC was also notified of the termination of the Unusual Event. The Emergency Director had terminated the Unusual Event at 1358 hours with the restoration of the second offsite source of power.

The telecommunications copper line was restored on June 25, 1998, and at 1700 hours on June 29, 1998, the fiber optic line was restored. At 1400 hours on June 28, 1998, only five ENS sirens remained out of service. This brought the total siren system availability to 90.7 percent, above the goal of 90 percent availability.

On June 29, 1998, during feedwater clean-up in preparation for restart, resin was found in the feedwater.

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

Apparent Cause of the Occurrence

The storm cell of June 24, 1998, was tracking southeast from Michigan and then eastward along Lake Erie, until suddenly shifting southeast making landfall directly adjacent to the Davis-Besse Nuclear Power Station (DBNPS) site. The DBNPS site was near the center of the storm cell, where cloud elevations and windspeeds were the greatest. The rapidly upward moving air feeding the center of the storm spawned, several funnel clouds, at least one of which touched down onsite and resulted in significant damage to the switchyard and unfortified structures such as outbuildings and roofs. The tornado was classified by the National Weather Service as an F2 (Fujita Scale) with winds ranging from 113 to 157 miles per hour (mph). The tornado damage resulted in a complete loss of offsite power. The three offsite lines, Ohio Edison, Lemoyne and Bayshore, were all disconnected from the switchyard. Offsite damage was significant, with eleven transmission towers of the Bayshore line destroyed. The EDGs were started prior to the LOOP and supplied their respective essential loads.

The first effects of the storm on the DBNPS facility were detected in the 345kV switchyard at about 2040 hours when air circuit breaker ACB 34561 opened and ACB 34562 opened and closed several times potentially due to lightning strikes. The apparent cause of the opening and closing of ACB 34562 is attributed the proper operation of the automatic breaker reclosing circuitry which is interlocked with synchronizing check relaying and associated lockout relaying. No equipment problems were found with ACB 34562 controls, it functioned as designed.

When the Control Room operators received the report of the funnel cloud on-site, they initiated a manual start of EDG 1 and 2 from the Control Room. The EDG 2 started successfully, but EDG 1 would not start. It was successfully started locally at 2046 hours. The cause of EDG 1 not starting from the Control Room was that Control Room start switch, HS1147B [EK-HS], had worn switch contacts. The switch was replaced and proper operation was verified.

The tornado and accompanying strong straight-line winds did significant damage to the electrical and telephone infrastructure within five miles of the plant. This damage caused the failure of two of the three available telephone systems that service DBNPS (fiber optic and copper lines). Only the microwave system remained operational. The event was a significant challenge to emergency response facility communications, but the established system was successful in mitigating the event and provided for continued safe operation of the station.

Storm damage from the tornado, strong winds and heavy rain external to the plant property caused severe damage to the Ottawa County electrical distribution system making 40 percent of the sirens in Ottawa County inoperable. A site inspection of the 26 affected sirens indicated no physical damage to any of the sirens. The sirens require 220 volt AC power to operate and failed due to loss of power. Following the storm, power was restored to the sirens.



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Apparent Cause of the Occurrence: (Continued)

The strong winds had significantly damaged the meteorological instrumentation; nine out of 12 meteorological instruments were inoperable. However, the 10-meter meteorological instrumentation for wind speed and wind direction is the primary instrumentation used to perform dose assessment calculations, as required, by the Emergency Plan and three of the four 10-meter instruments were operable immediately following the June 24, 1998, storm. Therefore, sufficient meteorological instrumentation was available to perform dose assessment calculations, if required. Additionally, wind speed and wind direction were available from the National Weather Service, which was contacted following the storm to verify meteorological instrumentation as well as to receive the weather forecast.

During the post-trip activities Atmospheric Vent Valve 2 (AVV2) was observed to have a control malfunction. The AVV2 could only either be full closed or opened to 10-14 percent. It was determined that the electro-pneumatic transducer (current to pressure or I/P converter), PY-ICS11A [SB-TD] had failed. The I/P converter was replaced and its function verified on June 28, 1998.

The EDG 1 ventilation failed to maintain the room temperature below the procedurally imposed 120 degrees F operating limit. This resulted in EDG 1 twice being declared inoperable. Even though EDG 1 had been declared inoperable, it did continue to operate and perform its safety function. The EDG room ventilation system consists of two safety grade, 50 percent capacity supply air fans which automatically start when the FDG is started. The ventilation system is sized to provide adequate outside air cooling to maintain the operating EDG room at 120 degrees F assuming 95 degrees F outside air per Updated Safety Analysis Report (USAR) Section 9.4.2.1.2.3. The ventilation system includes safety-grade modulating supply, exhaust and recirculation dampers which are interlocked through a room temperature controller. The dampers automatically modulate to maintain the room temperature between 60 degrees F and 120 degrees F for all operating conditions per USAR Section 9.4.2.1.2.3. The supply and exhaust air dampers fail closed and the recirculation damper fails open, to prevent freezing temperatures in the EDG room. The initial cause of the EDG ventilation failure to maintain temperature was determined to be a hydramotor failure on the recirculation damper. The ventilation system failed to its safety position of recirculation damper open (freeze conditions). Once the recirculation damper was closed, the EDG room began to cool but subsequently heated up. This heating of the EDG room for the second time is believed to be attributable to the fact that doors were opened and fans placed in the room to improve ventilation and cooling but were, in fact, contributing to the problem by circumventing the designed ventilation system, thus causing the room temperature to increase. However, EDG 1 room temperature remained above 120 degrees F for only approximately two and a quarter hours. A preliminary engineering evaluation has been performed and indicated that EDG operability may indeed not be limited to 120 degrees F, but final determination has not been completed. Further investigation and evaluation of EDG operability at temperatures above 120 degrees F and the EDG room ventilation system is still ongoing.

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## Apparent Cause of the Occurrence: (Continued)

The plant had entered the Emergency Plan in response to a tornado striking the facility and experienced a subsequent LOOP. The LOOP resulted in the loss of forced RCS flow and the loss of normal secondary side feedwater sources necessitating establishment of natural circulation cooling. The maximum cooldown rate allowed by procedure is 10 degrees F per hour. This procedural cooldown rate limit was developed to prevent drawing a steam bubble in the Reactor Head which would have the potential for disrupting natural circulation. The plant was in Mode 3 and had two methods of cooling available; natural circulation using the steam driven AFP and Motor Driven Feed Pump (MDFP) [BA-P] and Decay Heat (DH) removal using essential 4160 volt power. Because of the LOOP, the DH pumps would be powered from the EDGs. The uncertainty of the operability of the EDGs lead the ERO to determine that it would be more conservative to comply with the procedural guidance for natural cooldown and maintain two viable options to cool the reactor.

Inoperability of EDG 1 with no offsite source available necessitated entry into TS 3.0.3 requiring a RCS cooldown below 280 degrees F (Mode 4 HOT SHUTDOWN) within seven hours. Due to plant conditions, the ERO determined that the plant would be in the safest configuration if not cooled at a higher cooldown rate than allowed by procedure to comply with the TS 3.0.3 requirements. Operators conservatively continued to cooldown the plant near the maximum cooldown rate allowed procedurally (10 degrees per hour), but did not meet the TS 3.0.3 requirement. At 1913 hours on June 25, 1998, the Shift Supervisor invoked the provisions of 10CFR50.54(x) that allows for departure from TS requirements in emergency situations.

On June 25, 1998, Operations attempted to transfer bus C1/C2 supply from EDG 1 to B bus via ABDC1. The supply feed was being cross fed because there is no synchronized check relay for direct feed from the similar side 13.8 kV bus when the respective diesel is running. When the switch for ABDC1 was closed, the breaker did not close. Investigation revealed circuit breaker ABDC1 failed to close due to no gap existing between the tripping cam and the open plunger. When there is no gap between the tripping cam and the open plunger, the open plunger may be already depressed sufficiently to maintain the breaker in a tripped state.

Station Vent Radiation Monitor, RE4598BA was potentially damaged due to rainwater intrusion due to damage to the Turbine Building Roof. Repetitive spiking of RE4598BA coupled with RE 4598AA being out of service for calibration resulted in the TS 3.0.3 entry on June 26, 1998. A subsequent engineering evaluation of the instrument indications and the observed failure mode, determined that while the radiation monitor was exhibiting spurious high spikes, it would have fulfilled its function. Based on the evaluation, RE 4598BA was declared operable on June 26, 1998, at 0455 hours.

The loss of offsite power, in combination with the loss of electrical distribution panel YAU, resulted in condensate polishers isolation valves and the condensate pump minimum recirculation valve failing open. This permitted a flowpath from the Deaerators [DEA] to the Hotwell that backflushed an unknown quantity of secondary polisher resin into the Condensate System [SD]. During plant startup, the condensate pumps [SD-P] were started with the polisher bypass valve open in accordance with approved procedures, which permitted resin to enter the Feedwater System [SJ]. This condition was detected on June 29, 1998, during the feedwater clean-up in preparation for the restart.

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Analysis of Occurrence:

There were no safety concerns identified during or as a result of this event. The RPS was the initiator of the reactor trip due to high RCS pressure. All control rods inserted into the core as designed. The SFRCS functioned to initiate Auxiliary Feedwater supply to the OTSGs. The AFPs functioned to provide auxiliary feedwater to both OTSGs.

The DBNPS USAR Section 3.3, Wind and Tornado Design, describe the station design criteria for various plant systems. The design features for protection against extreme wind conditions or tornado is reflective of the criteria established for Seismic Qualification, Category I. The evaluation states that seismic category I structures would be expected to withstand the energies exacted by a tornado generating winds at 300 mph, exceeding tornado class F5 criteria. Seismic category I structures, as described in USAR Section 3.3.2.1, include the shield building, auxiliary building, intake structures, valve rooms number 1 and 2, service water tunnel, and the three electrical manholes. The issue of a tornado strike, as described in the USAR, relates directly to the ability to maintain equipment and systems required for the safe shutdown of the plant. Table 3.3-1 of the USAR delineate essential systems required for a safe shutdown in the event of a tornado. All equipment listed in Table 3.3-1 is located within one of the structures identified in USAR Section 3.3.2.1 as being seismic category I and is, therefore, assumed by design to be available in the event of a tornado strike on the plant. The tornado experienced by DBNPS site on the evening of June 24, 1998, was categorized by the National Weather Service as an F2 tornado, exhibiting winds between 113 and 157 mph. The force of this storm was well within the design basis for extreme wind and tornado. The response of critical systems was as anticipated and all such systems were available for safe shutdown of the plant in response to the tornado strike on June 24, 1998.

Both EDGs were manually started prior to the loss of offsite power and supplied their respective essential loads. During the LOOP event, EDG room temperatures increased such that EDG 1 was declared inoperable. Both EDGs, however, were capable of operating and did, in fact, function with slightly elevated room temperatures. The DBNPS was analyzed in USAR Section 15.2.9, Loss of all AC Power to the Station Auxiliaries (Station Blackout), for a complete loss of all AC power. Given the fact that both EDGs were functional and the Station Blackout Diesel Generator [EK-DG] was operable, the plant was within the condition analyzed in the USAR.

Safety of the public was paramount during the decision to maintain the plant cooldown rate within the procedural limits in order to not challenge natural circulation and ensure cooling for the reactor. Based on this condition, the provisions of 10CFR50.54(x) were invoked. The health and safety of the public was not endangered as a result of a tornado striking the DBNPS on June 24, 1998.



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Corrective Actions:

Offsite power was restored and declared operable at 2320 hours on June 25, 1998, when the Ohio Edison line was returned to service. The Lemoyne line was returned to service and declared operable on June 26, 1998, at 1130 hours. Re-energization of the final offsite transmission line, Bayshore, was accomplished on July 13, 1998.

The EDG 1 recirculation damper hydramotor was repaired and restored to operable. The operability of the EDGs at temperatures in excess of 120 degrees F continues to be evaluated. The performance of the EDG room ventilation is also being evaluated.

The EDG 2 governor was checked out to determine the cause of the malfunction. There were no problems with either the electric or hydraulic governor controls. The emergency start, non-essential trip bypass relay, R3 [68] was replaced and verified to be functional. The EDG 2 was ran successfully and no other problems were found.

The switchyard equipment and transformers were inspected for extent of visible damage, and protective relaying target indications were reviewed for possible indication of further damage. No damage was indicated and the transformers were electrically tested satisfactorily. The damaged Motor Operated Disconnects (MODs) [MOD] were disassembled, reworked and reassembled.

An enclosure was built around RE 4598AA, AB, BA and BB to prevent further water intrusion. The monitors were dried to the extent possible and an air conditioner was placed in the enclosure to help reduce moisture. The calibration of RE 4598AA resumed on June 26, 1998, and was completed on June 27, 1998, making the monitor operable. The monitor RE 4598BA channel 2 spiked once on June 26, 1998, and began spiking again on June 28, 1998. The RE 4598BA channel 2 detector was replaced and calibrated on June 29, 1998.

The telecommunications copper line was restored on June 25, 1998, and at approximately 1700 hours on June 29, 1998, the fiber optic cable was returned to service. Four additional microwave lines have since been added; two to the Control Room, one to the Shift Manager's office and one to the Auxiliary Shutdown Panel.

An Ottawa County Tone Alert Radio was installed in the Operations Work Support Center to improve the availability of weather information to the site. Also, the procedure HS-EP-02810, Tornado, is being reviewed.

As power was restored, the failed sirens were tested and returned to service. NRC Administrative Letter 97-03, Plant Restart Discussions Following Natural Disasters, dated March 28, 1997, was reviewed and it was determined that the siren system should have an availability of greater than 90 percent prior to plant restart. This was achieved on June 28, 1998, at 1400 hours. The State of Ohio Emergency Management Agency (OEMA) and the Federal Emergency Management Agency (FEMA) concurred that the state of offsite emergency preparedness was adequate to support plant restart.

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## Corrective Actions: (Continued)

Because of the failure experienced on ABDC1 circuit breaker, inspections were completed of all open 4160 volt circuit breakers and selected open 13.8 kV volt circuit breakers. Circuit breakers HX02A, AC208, the spare in breaker ABDC1 and ABDC1 (when installed) were the circuit breakers found to have no gap between the floor cam and the plunger. The lack of gap was corrected. Standing Order 98-012 has been issued to operators to inspect all 13.8 kV and 4160V circuit breakers following switching evolutions such that the circuit breakers that are currently closed are inspected for lack of gap. Operations procedure DB-OP-01000, Operation of Station Breakers, will be revised to include the significance of no gap existing between the circuit breaker tripping cam and open plunger and its effect upon breaker availability. Additional training will be provided to Operations and Electrical Maintenance personnel to reinforce the importance of ensuring that adequate clearance exists between the tripping cam and the open plunger when racking in all 13.8 kV and 4160 V circuit breakers.

Once the resin intrusion into the feedwater system was detected, the condensate and feedwater systems were flushed in accordance with DB-OP-06223, Main Feedwater System. The system dead legs and bypass valves were also flushed using DB-OP-00016, Removal and Restoration of Station Equipment, lineups. On July 22, 1998, a plant shutdown was initiated for further fill, soak and drains of the steam generators. A plant startup was initiated and the Main Generator was synchronized to the grid on July 26 at 2150 hours.

A independent self-assessment of the events leading up to the invocation of the provisions of 10CFR50.54(x) was conducted by a team involving offsite personnel. The team concluded that the invocation of 10CFR50.54(x) was an appropriate option.

A senior management critique and ERO facility critiques were conducted. The lessons learned as well as enhancements identified are being reviewed for incorporation, as appropriate.

## Failure Data:

No events of this type have occurred at Davis-Besse Nuclear Power Station in the past.

NP-33-98-006-0

PCAQRs 98-1307, 98-1335, 98-1304,  
98-1290, 98-1313, 98-1309, 98-1340,  
98-1302, 98-1362, 98-1333, 98-1392,  
98-1299, 98-1301, 98-1291, 98-1300,  
98-1371, 98-1334, 98-1294

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ATTACHMENT 1  
SEQUENCE OF EVENTS

- 06/24/98 2040 Switchyard Air Circuit Breaker (ACB) 34561 and 34562 opened. ACB 34562 closed and reopened several times before remaining open
- 2044 Report of funnel cloud by Cooling Tower EDG 2 started
- 2045 ACB 34564 opened (Ohio Edison line)
- 2046 EDG 1 was successfully started locally
- 2047 ACB 34563 (Lemoyne line) opened; complete loss of offsite power source.
- Reactor trip; SFRCS initiated
- 2118 - Alert declared by the Shift Supervisor  
- Shift Supervisor assumes Emergency Director duties  
- Computer Automated Notification System (CANS) pages the Emergency Response Organization (ERO) but fails due to the lack of operable offsite telephone lines.
- 2120 Transferred feedwater to Motor Driven Feed Pump in Auxiliary Feedwater Mode.
- 2124 Ottawa County notified
- 2128 Attempted to notify Lucas County
- 2136 Nuclear Regulatory Commission (NRC) notified
- 2223 Emergency Offsite Manager manually activates the group pages to notify the ERO of the Alert
- 2227 Emergency Director turnover to Emergency Assistant Plant Manager



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ATTACHMENT 1  
SEQUENCE OF EVENTS

- 2238 Entered Technical Specification 3.8.1.1 Action d. Restore one offsite line within 24 hours or be in Hot Standby in next 6 hours.
- 2322 Operations Support Center (OSC) activated.
- 2338 Technical Support Center (TSC) activated.
- 2348 Emergency Control Center (ECC) activated.
- 2353 Commenced natural circulation plant cooldown in accordance with DB-OP-06903, Plant Shutdown and Cooldown.
- 06/25/98 0140 Joint Public Information Center (JPIC) activated.
- 0817 Opened outside doors to EDG rooms
- 0829 Annunciator 1-1-A, EDG 1 trouble, alarms on high EDG room temperature greater than 104 degrees F
- 0900 26 of 54 sirens did not respond when polled from the Emergency Control Center
- 1025 EDG 1 Room Temperature is 122 degrees F. EDG 1 is declared inoperable. Plant enters TS 3.0.3, NRC notified at
- 1037 EDG 1 room ventilation recirculation damper appears to be failed open causing high room temperature. OSC to investigate.
- 1132 Hooked up two fans in EDG 1 room
- 1153 Control Room and TSC discussed the RCS cooldown options based on entry into TS 3.0.3.
- 1203 EDG 1 room ventilation recirculation damper closed
- 1210 Opened YE 201, EDG 1 Ventilation Recirculation Damper. Mechanically disconnected and manually closed damper.

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ATTACHMENT 1  
SEQUENCE OF EVENTS

- 1232 EDG 1 room temperature is now 119 degrees F. Exit TS 3.0.3.
- 1313 EDG 1 room temperature is 122 degrees F. EDG 1 is declared inoperable, enter TS 3.0.3
- 1530 Blocked doors 317, 319 and 322 open to cool EDG 1
- 1533 Installed more fans. Temperature stabilized at 114 degrees F
- 1926 Energized Ohio Edison line from offsite
- 1931 At 1913, the requirement of TS 3.0.3 was not met, be in hot shutdown within six hours of the time that EDG 1 was declared inoperable. This TS requirement could not be met due to being in natural circulation, 10CFR50.54(x) was invoked.
- 2005 Took air flow readings on EDG 1 and 2 ventilation fans. Both fans producing design flow.
- 2304 While transferring D1/D2 buses from EDG 2 to A Bus, Received "EDG 2 Fault" and "EDG Frequency" annunciators. EDG 2 frequency increased to 65 Hz and AD101 was opened and would not respond to shutdown pushbutton. Transferred to HYD governor and lowered shutdown pushbutton
- 2315 EDG 2 wen't shutdown. Troubleshooting electronic governor
- 2320 EDG 2 shutdown with no additional action taken
- Declared EDG 2 inoperable
  - Declared the Ohio Edison line operable
  - EDG 1 is currently inoperable due to questions with ventilation, but is still functional. The station is currently in TS 3.0.3
- 2345 EDG 2 declared inoperable

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ATTACHMENT 1  
SEQUENCE OF EVENTS

06/26/98 0125 Shut EDG 1 and EDG 2 room doors

0200 Alert downgraded to an Unusual Event under E.A.L 9.2. TSC and OSC to remain manned.

0340 EDG 1 declared operable based on operable ventilation and current room temperature less than 120 degrees F

0454 Declared Radiation Monitor RE 4598 BA operable.

1130 Declared second offsite AC source (Lemoyne line) operable.

1240 RE 4598 BA declared inoperable RE 4598 AA already inoperable. Entered TS 3.0.3 due to both Station Vent Radiation Monitors being inoperable.

1358 Emergency Director terminates the Unusual Event.

06/28/98 0600 8 of 54 sirens did not respond when polled from the ECC

1400 Only 5 sirens were out of service (1102, 1105, 1109, 1203 and 1504). This brought the total siren system availability to 90.7 percent.



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ATTACHMENT 2  
345 KV SWITCHYARD ONE LINE