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Power Company
Cook Nuclear Plant
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Bridgman, MI 49106
616-465-5901



June 12, 2000

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

Operating Licenses DPR-58 and DPR-74
Docket Nos. 50-315 and 50-316

Document Control Manager:

In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Report System, the following report is being submitted:

LER 315/2000-003-00, "Inadequate Protection of Electrical Switchgear Ventilation Structures from Tornado Hazards."

The following commitment was identified in this submittal:

- A modification is planned for the Unit 1 ventilation hoods prior to Unit 1 startup, to install new hoods that are tornado wind resistant, designed to withstand design basis seismic loads, and raised in height to better prevent rain and snow intrusion.

Should you have any questions regarding this correspondence, please contact Mr. Robert C. Godley, Director, Regulatory Affairs, at 616/465-5901, extension 2698.

Sincerely,

A handwritten signature in black ink that reads 'M. W. Rencheck'.

M. W. Rencheck
Vice President – Nuclear Engineering

/mbd
Attachment

c: J. E. Dyer, Region III
R. C. Godley
D. Hahn
W. J. Kropp
R. P. Powers
R. Whale
Records Center, INPO
NRC Resident Inspector

LICENSEE EVENT REPORT (LER)

(See reverse for required number of 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

FACILITY NAME (1)

Donald C. Cook Nuclear Plant Unit 1

DOCKET NUMBER (2)

05000-315

PAGE (3)

1 of 4

TITLE (4)

Inadequate Protection of Electrical Switchgear Ventilation Structures from Tornado Hazards

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	
05	15	2000	2000	-- 003 --	00	06	12	2000	Cook Plant Unit 2	05000-316	
OPERATING MODE (9) -- THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)											
POWER LEVEL (10) 0%			20.2201 (b)		20.2203(a)(2)(v)		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

M. B. Depuydt, Regulatory Affairs

TELEPHONE NUMBER (Include Area Code)

616 / 465-5901, x1589

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)

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 May 15, 2000, with Unit 1 defueled and Unit 2 in Mode 5, Cold Shutdown, it was determined that a condition outside the design basis of the plant existed in that the electrical switchgear room ventilation intake and exhaust structures were susceptible to damage by tornado-generated hazards. The ventilation hoods are not adequately protected from tornado hazards, and could be blown off the roof, allowing moisture intrusion that could adversely impact electrical equipment in the room, or could be crushed by high winds or a missile, blocking ventilation flow to areas of the switchgear rooms. The postulated tornado-generated damage to the switchgear ventilation system could degrade the capability of the system to a point that would prevent plant components from performing their safety functions, and represents a non-conformance with the design criterion in the Updated Final Safety Analysis Report. This LER is submitted in accordance with 10 CFR 50.73(a)(2)(ii) for a condition outside the design basis of the plant.

The cause for this event was the failure to adequately address tornado hazards in the original plant design. Corrective actions include development of a new procedure, 12 OHP 4022.001.010, "Severe Weather," to provide guidance for site activities in the event of severe weather conditions, installation of a modification on the Unit 2 switchgear ventilation hoods and a planned modification for the Unit 1 ventilation hoods to make them tornado wind resistant, and submittal of a license amendment request to allow the application of statistical analyses to the design of tornado missile protective features for the switchgear ventilation system.

There is low safety significance associated with the tornado-generated hazard impact to the electrical switchgear ventilation system.

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER(2)	LER NUMBER (6)				PAGE (3)
		YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	
		2000	--	003	--	
Donald C. Cook Nuclear Plant Unit 1	05000-315					2 of 4

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

Conditions Prior to Event

Unit 1 was Defueled
Unit 2 was in Mode 5, Cold Shutdown

Description of Event

On May 15, 2000, during an evaluation of tornado-generated missile hazards prompted by the condition described in LER 315/1999-020-00, "Emergency Diesel Generators (EIGS: DG) Declared Inoperable Due to Inadequate Protection of Air Intake, Exhaust and Room Ventilation Structures from Tornado Missile Hazards," it was determined that that a condition outside the design basis of the plant existed in that the electrical switchgear room ventilation intake and exhaust structures were susceptible to damage by tornado-generated hazards.

The electrical switchgear room ventilation hoods are constructed of galvanized sheet metal and are mounted on top of 18-inch high concrete curbs on the roof of the Auxiliary Building. The hoods are designed to keep rain and snow from being drawn into the ventilation shafts that provide cooling to the switchgear rooms housing the 4160 VAC, 600 VAC, Control Room Instrument Distribution (CRID), and 250 VDC safety and non-safety related distribution systems. These hoods are not adequately protected from tornado-generated hazards, and could be blown off the roof, allowing moisture or debris intrusion that could adversely impact electrical equipment in the room, or could be crushed by high winds or a missile, blocking ventilation flow to areas of the switchgear rooms. Moisture intrusion into the switchgear rooms could result in development of electrical grounds in the switchgear and failure of safety related electrical equipment. Insufficient separation exists between one pair of ventilation hoods such that a single tornado-generated missile could affect more than one train of redundant electrical switchgear. Reduced ventilation flow to the switchgear rooms could result in exceeding switchgear design temperature limits. The postulated tornado-generated damage to the switchgear ventilation system could degrade the capability of the system to a point that would prevent plant components from performing their safety functions, and represents a non-conformance with the design criterion in the Updated Final Safety Analysis Report.

The susceptibility of the electrical switchgear room ventilation system to damage from tornado-generated hazards was determined to be reportable, and this LER is submitted in accordance with 10 CFR 50.73(a)(2)(ii) for a condition outside the design basis of the plant.

Cause of Event

The cause for this event was the failure to adequately address tornado-generated hazards in the original plant design. Specific discrepancies related to this condition are uncontrolled modifications, calculations, and supporting documentation for the current design basis, and an incomplete understanding of the tornado-generated hazards design bases.

These issues are symptoms of a larger generic issue, inadequate design and licensing basis control, due to a failure to recognize that maintaining the design basis and providing strong configuration management are vital functions in nuclear power operations.

Analysis of Event

The design criterion specified in the Updated Final Safety Analysis Report (UFSAR), Section 1.4.1.2, states that "structures, systems and components of reactor facilities which are essential to the prevention, or to the mitigation of the consequences, of nuclear accidents which could cause undue risk to the health and safety of the public shall be designed, fabricated, and erected to performance standards that enable such structures, systems and components to withstand, without undue risk to the health and safety of the public, the forces that might reasonably be imposed by the occurrence of an extraordinary natural phenomenon such as earthquake, tornado, flooding condition, high wind or heavy ice."

The electrical switchgear room ventilation system is a safety related, seismic Class 1 system which functions to maintain the ambient temperatures in switchgear rooms at or above the design minimum temperature and at or below the design

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER(2)	LER NUMBER (6)				PAGE (3)
		YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	
		2000	--	003	--	

Donald C. Cook Nuclear Plant Unit 1

05000-315

3 of 4

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

maximum temperature for the equipment contained in the rooms, while preventing moisture intrusion from the external environment. The design of the switchgear ventilation intake and exhaust hoods would not have prevented tornado-generated wind or missile damage causing removal of the hoods, resulting in moisture and debris intrusion to the electrical cabinets. The 18-inch concrete curbs at the base of the hoods would have prevented water on the roof from flowing down into the ventilation shafts, but removal of the ventilation hood would allow rain or snow and debris to fall or be drawn down the shaft. Most of the water would be thrown to the bottom of the ductwork where it would run along the ducting and out the register(s). One duct, however, discharges directly over a 600 VAC motor control center electrical cabinet that may experience electrical malfunctions due to moisture. Water accumulation in the bottom of the ductwork could also be forcefully dispersed into the rooms by the ventilation fans, but the water would have to negotiate the 90 degree turns to exit the registers. Ventilation fan malfunctions may also result from the intrusion of moisture into the ductwork. The majority of the water will end up falling to the floor of the switchgear rooms.

To reach a condition whereby significant moisture intrusion into the switchgear rooms would have occurred such that several trains of equipment were impacted, either the correct combination of ventilation hoods must be removed from both units, or all hoods must be removed. Tornado-generated winds would have to reach greater than 130 miles per hour to cause removal of some or all the switchgear ventilation hoods. The existing hoods were designed for heavy winds up to 130 miles per hour, and include a design margin above that value. A calculation was performed to determine the probability of occurrence for a tornado at the Donald C. Cook Nuclear Plant (CNP) site with winds in excess of 130 miles per hour, and for winds associated with the design basis tornado of 360 miles per hour. The calculated probability of any portion of the CNP site being struck by tornado winds in excess of 130 miles per hour was 1.76E-4 per reactor year, and for the design basis tornado was 8.0E-8 per reactor year. The probability of tornado winds removing or damaging the right combination of ventilation hoods at both units and impacting safe shutdown of the CNP units is judged to be considerably lower than the calculated probabilities of a tornado event. Thus, the safety significance of this condition is considered low.

Tornado-generated wind or missile damage to the hoods resulting in crushing the hoods or debris intrusion into the ventilation shafts would result in a reduction of cooling to the switchgear rooms. The bounding case for loss of room cooling would be that all hoods were damaged and no ventilation flow to the various rooms would occur, an extremely conservative position. Temperatures in the rooms would rise and could exceed the design temperature of 104 degrees F in as little as 30 minutes. The high temperature alarm setpoint would be exceeded and annunciate the high temperature condition in the control room. The elevated temperatures would remain for a short duration while ventilation is restored to the area.

A tornado that strikes the CNP site would most likely cause a loss of offsite power, an event for which CNP is analyzed. NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," Appendix F Topical Report, Section 3.2, concludes that electrical components designed for continuous operation at 104 degrees F can be expected to operate at 150 degrees F for at least the full four hours duration of a station blackout. Calculations show that none of the switchgear rooms are expected to reach 150 degrees upon loss of ventilation. The station blackout analysis can be considered the bounding event for a loss of switchgear room cooling due to tornado-generated hazards.

Calculations were performed to determine the probability of tornado-generated missiles striking certain electrical switchgear ventilation hood targets in various combinations. The methodology is based on an approach documented in NRC accepted Electric Power Research Institute report NP-2005, "Tornado Missile Simulation and Design Methodology." Probabilities that tornado-generated missiles will strike individual hoods vary from 9.9E-9 to 8.0E-8 for the Unit 2 ventilation hoods, and from 1.3E-8 to 1.6E-7 for the Unit 1 ventilation hoods. The probabilities for rain intrusion into the switchgear rooms as a result of a tornado missile strike vary from 6.7E-8 to 4.8E-7 for both units. Based on the extremely low probability of tornado-generated missiles affecting the roof mounted ventilation hoods, there is reasonable assurance that

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER(2)	LER NUMBER (6)				PAGE (3)
		YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	
		2000	--	003	--	
Donald C. Cook Nuclear Plant Unit 1	05000-315					4 of 4

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

the electrical switchgear room ventilation systems for both units will not be damaged by tornado-generated missiles such that safety related systems could not perform their intended safety functions.

There is low safety significance associated with the tornado-generated hazard impact to the electrical switchgear ventilation system.

Corrective Actions

There were no immediate corrective actions associated with the inadequate electrical switchgear ventilation hood design, because both units were in a shutdown condition.

A new procedure, 12 OHP 4022.001.010, "Severe Weather," was written to provide guidance for site preparations in the event of tornadoes, thunderstorms, high winds, or other severe weather conditions as determined by the Shift Manager. Attachment B, "Switchgear Area Ventilation Evaluation," of the severe weather procedure provides guidance to ensure adequate ventilation is provided to the switchgear rooms in the event of severe weather damage, including tornado-generated damage, to the switchgear ventilation.

A modification has been performed on the Unit 2 switchgear ventilation hoods, and is planned for the Unit 1 ventilation hoods prior to Unit 1 startup, to install new hoods that are tornado wind resistant, designed to withstand design basis seismic loads, and raised in height to better prevent rain and snow intrusion.

A license amendment request was submitted to allow the application of statistical analyses to the design of tornado missile protective features for the switchgear ventilation system.

The corrective actions to prevent recurrence for the root cause of the generic inadequacies of the design control process are being addressed through the CNP Corrective Action Program. The root cause evaluation identified numerous corrective actions to address management, organizational, and programmatic issues in the Engineering organization.

Previous Similar Events

315/99-020-00	315/99-018-00
315/99-013-00	315/99-012-00
315/99-011-00	315/99-010-00
315/91-005-00	