

## 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  
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TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE  
INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 P33), 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)

Clinton Power Station

DOCKET NUMBER (2)

05000461

PAGE (3)

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TITLE (4)

Design of Diesel Generator Ventilation Subsystems Outside Design Basis as a Result of Failure to Include Minimum and Maximum  
Outside Air Temperature Extremes Due to Design Error

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
09	29	86	97	022	01	11	13	97	None	05000
									FACILITY NAME	DOCKET NUMBER
									None	05000
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)								
4		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)			X	50.73(a)(2)(ii)	50.73(a)(2)(x)
000		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)	X 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)			X	50.73(a)(2)(vii)	in NRC Form 366A

## LICENSEE CONTACT FOR THIS LER (12)

NAME

M. M. Gandhi, Engineering Projects Engineer

TELEPHONE NUMBER (Include Area Code)

(217) 935-8881, Extension 4082

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

## SUPPLEMENTAL REPORT EXPECTED (14)

EXPECTED  
SUBMISSION  
DATE (15)

MONTH DAY YEAR

YES

X NO

(If yes, complete EXPECTED SUBMISSION DATE).

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

The diesel generator (DG) room ventilation system was designed based on an outside air temperature range of -2 degrees Fahrenheit (F), winter minimum temperature, and 96 degrees F, summer maximum temperature. The Updated Safety Analysis Report (USAR) identifies temperature extremes of -22 degrees F and 112 degrees F based on surrounding area temperature data. Analysis determined that the DG ventilation system is unable to maintain DG room temperature within the design limit during the area extreme high temperature identified in the USAR. The cause for this condition was design engineers' oversight. During the investigation, annunciator power supplies located in the DG rooms were identified as not meeting Class 1E qualification due to improper implementation of a design modification. Corrective actions include revising procedures, evaluating components for increased room temperature, installing a temporary modification to reduce temperature inside a control panel, design changes to the DG Direct Current (DC) electrical distribution system, reviewing other ventilation systems for the design deficiencies, correcting the USAR, correcting the DG DC annunciator power supply Class 1E deficiency, evaluating the effects of outside air temperature extremes and verifying Class 1E deficiencies do not exist in other control panels. This condition is reportable under 10CFR21.

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## DESCRIPTION OF EVENT

On July 24, 1997, the plant was in Mode 4 (COLD SHUTDOWN) for the sixth refueling outage (RF-6). Reactor (RCT) coolant temperature was being maintained within a band of 100 to 120 degrees Fahrenheit (F) and pressure was zero pounds per square inch. Engineers were investigating condition report (CR) 1-97-06-302 which identified an issue involving increased Emergency Diesel Generator (EK) Room Heating, Ventilating, and Air Conditioning (HVAC) system (VJ) fan (FAN) horsepower consumption during low outside ambient temperature conditions.

At about 0745 hours, during the investigation, questions were raised about the design of the diesel generator room ventilation subsystems. The diesel generator room ventilation subsystems were designed to limit the temperature in the diesel generator room to 130 degrees F with the diesel generator operating and between 65 degrees F and 104 degrees F when the diesel generator is not operating. These design requirements were based on an outside air temperature range of minus 2 degrees F, winter minimum temperature, and 96 degrees F, summer maximum temperature, or 1 percent and 99 percent of the temperature extremes for Central Illinois. The diesel generator ventilation system was designed in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Fundamentals Handbook chapter on weather data and design conditions. However, the Clinton Power Station (CPS) Updated Safety Analysis Report (USAR) identifies surrounding area extremes of minus 22 degrees F (Springfield, IL) and 112 degrees F (Springfield, IL). Actual Clinton Power Station extremes documented in the USAR are minus 19.8 degrees F and 95.4 degrees F. Due to the limitations of the original design requirements, it was determined the diesel generator room ventilation subsystems may not be adequate to support operability of the diesel generators during extreme outside temperatures that exceed the recommended levels in the ASHRAE Fundamentals Handbook.

The Operations Shift Supervisor was notified about this issue at 0830 hours, and he directed that Engineering perform further evaluations.

CR 1-97-07-250 was initiated to investigate and track the extreme temperature issue. On July 25, 1997, at approximately 0051 hours, an operability determination completed by the Operations Shift Supervisor concluded that the outside ambient temperature band required for proper operation of the Diesel Generator Room HVAC system was 5 degrees F to 102.7 degrees F for the Divisions 1 and 2 diesel generator rooms, and 5 degrees F to 104 degrees F for the Division 3 diesel generator room. This was based on an engineering evaluation which determined that when outside temperatures are below 5 degrees F or above 102.7 degrees F for the Divisions 1 and 2 diesel generator rooms, and below 5 degrees F or above 104 degrees F for the Division 3 diesel generator room, the DG HVAC system may not maintain the temperature in these rooms within design limits.



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The Operations Shift Supervisor implemented interim actions to ensure continued operability of the emergency diesel generators. On July 25, 1997, surveillance procedures CPS 9000.01 D001, "Control Room Surveillance Log - Mode 1, 2, 3," and CPS 9000.01 D002, "Control Room Operator Surveillance Log - Mode 4, 5 Data Sheet," were revised to require monitoring of outside air temperature. If outside ambient temperature was not within the required temperature range for the respective diesel generator (5 to 102.7 degrees F for Divisions 1 and 2, or 5 to 104 degrees F for Division 3), appropriate actions in accordance with CPS Technical Specifications for the inoperable diesel generator(s) were to be taken. On August 4, 1997, CPS surveillance procedures 9000.01 D001 and 9000.01 D002 were revised again to require actions in accordance with CPS administrative procedure 1014.06, "Operability Determination," and the CPS Technical Specifications for the inoperable diesel generator(s). Further analysis showed that temperatures higher than 102.7 degrees F were acceptable for Division I and II diesel generator rooms; however, to ensure conservative operation, CPS procedures were not revised to reflect the higher temperature.

As a long-term solution to the Diesel Generator area extreme high temperature issue, an evaluation was performed to determine the maximum temperature that the diesel generator rooms could reach during the area extreme high outside air temperature of 112 degrees F. The evaluation determined that the diesel generator room temperature could be maintained at or below 140 degrees F during this condition. Engineering then commenced an evaluation to ensure that all diesel generator supporting components were operable for temperatures up to 140 degrees F.

On August 21, 1997, at about 1730 hours, during the evaluation, engineers determined that temperatures within the Division 3 diesel generator control panel (located within the Division 3 DG room) could reach 23 degrees F higher than room temperature. An annunciator power supply [JX] within the Division 3 diesel generator control panel was not qualified for temperatures above 140 degrees F. Overheating of the annunciator power supply could result in a low impedance fault which could cause the control power [JC] circuit breaker [BKR] in the DG Direct Current (DC) Distribution Panel to open, shutting down the diesel generator. It was determined that outside air temperatures greater than 91 degrees F could cause temperatures in the annunciator control panel to exceed 140 degrees F (140 degrees F, minus 26 degrees F room temperature rise, minus 23 degrees F panel temperature rise, equals 91 degrees F outside air temperature), thereby exceeding the maximum design temperature of the DC annunciator power supply. CR 1-97-08-204 was initiated to investigate and track this issue. The original operability determination was revised as a result of this finding and a temporary modification was initiated to remove the control panel doors to equalize room temperature and control panel temperature. This temporary modification restored the Division 3 diesel generator to an operable status.

Investigation of the DC annunciator power supplies associated with the Division 1 and Division 2 diesel generators on August 29, 1997, found that they too were only qualified to 140 degrees F. These power supplies are located in control panels similar to Division 3 where temperatures inside the panel could be 23 degrees higher than room temperature. A low impedance fault on the DC power supplies for these diesels could also result in DG shutdown.

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Also on August 29, 1997, engineers discovered the annunciator power supplies for the Division 1 and Division 2 diesel generators were not Class 1E qualified. These power supplies do not perform a safety-related function; however, they are connected to the Class 1E DC diesel generator electrical distribution system [EJ]. Section 8.3.1.4.1.4 of the USAR requires Non-Class 1E, non-division associated components, be electrically isolated from Class 1E systems by an acceptable Class 1E isolation device or have an adequate justification and analysis for Non-Class 1E isolation. Engineers determined that Division 1 and Division 2 diesel generator annunciator power supplies did not have Class 1E isolation and there was no justification provided. At this time both Division 1 and Division 2 diesel generators were inoperable for other reasons. A Limiting Condition for Operation Action Statement (Technical Specification [TS] 3.8.2), was entered to ensure that the Non-Class 1E power supply issue and the high temperature issue for Division 1 and 2 diesel generators were corrected prior to declaring the Division 1 and Division 2 diesel generators operable. CR 1-97-09-201 was written to investigate and track this issue.

The design of the diesel generator room ventilation subsystems was determined not to be in accordance with the licensing basis of the plant. The design deficiency in the diesel generator ventilation subsystems had existed since initial plant operation on September 29, 1986, when the plant was in Mode 5 (REFUELING) for initial fuel loading. At that time, reactor coolant temperature was ambient and pressure was atmospheric. The Non-Class 1E DC annunciator power supplies for Division 1 and 2 DGs were also not in accordance with the licensing basis of the plant. This condition had existed since February 20, 1991, for the Division 1 DG and January 29, 1992, for the Division 2 DG.

No automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No other equipment or components were inoperable at the start of this event to the extent that their inoperable condition contributed to this event.

## CAUSE OF EVENT

The cause for the diesel generator ventilation system being inadequate during extreme ambient high temperatures was due to design engineers' oversight. The cause for the DC annunciator power supplies for Division 1 and 2 diesel generators not meeting Class 1E qualification requirements was determined to be improper implementation of a plant modification. A review during the modification process identified that provisions should be made for Class 1E use; however, this requirement was never implemented prior to final approval.

## CORRECTIVE ACTION

An engineering evaluation for outside area extreme low temperatures has determined that the diesel generator rooms can be maintained within the design limits for the diesel generator.

An engineering evaluation was performed to verify diesel generator support equipment operability during outside area extreme high temperature. It was determined that all diesel generator components remain operable up to the corresponding room and cabinet temperature associated with the area extreme high temperature, with the exception of the DC annunciator power supplies.



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Electrically coordinated class 1E fuse protection will be provided for the DC annunciator power supplies in Division 1, 2 and 3 diesel generator control panels. This protection will prevent a low impedance fault of the DC annunciator power supplies from tripping the diesel generator control power. This design change also satisfies proper class 1E isolation requirements for the Division 1 and 2 DGs in accordance with USAR Section 8.3.1.4.1.4 for connections between non-Class 1E components and Class 1E systems. The coordinated fuse protection has been installed in Division 1 Diesel Generator and will be installed in Division 2 and 3 Diesel Generators prior to plant start up.

Surveillance procedures CPS 9000.01 D001 and CPS 9000.01 D002 have been revised to monitor outside air temperature. If outside temperature is not within the required temperature range for the respective diesel generator, appropriate actions will be taken in accordance with CPS administrative procedure 1014.06, "Operability Determination," and the CPS Technical Specifications for the inoperable diesel generator(s). These temperature monitoring requirements and limitations will be discontinued once class 1E fuse protection is installed.

A Temporary Modification was installed on the Division 3 DG control panel to remove the panel doors allowing the temperature inside the panel to equalize with DG room temperature. This temporary modification will be withdrawn after the Class 1E electrically coordinated fuse protection is installed for the DC annunciator power supply.

Other safety-related HVAC systems with very high outside air flow rates and/or low thermal inertia with short air changes were reviewed to identify if similar issues to those discussed in this event exist. No other deficiencies were found.

The CPS USAR will be revised to accurately identify the diesel generator room temperature limitations.

Other class 1E panels with the same DC annunciator power supply as those in the Division 1 and 2 DG control panels were evaluated for compliance with USAR section 8.3.1.4.1.4. No deficiencies were identified.

## ANALYSIS OF EVENT

This event is reportable under several criteria or provisions of 10CFR50.73. The event is reportable under the provisions of 10CFR50.73(a)(2)(ii)(B) because the design of the diesel generator room ventilation subsystems, and the design of the Division 1 and 2 DC annunciator power supplies, are not in accordance with the design requirements of the plant. The diesel generators are required to mitigate the consequences of an accident in the event of a concurrent loss of offsite power. Failure of the DC annunciator power supplies could have prevented the diesel generators from fulfilling their safety function, therefore this event is reportable under 10CFR50.73(a)(2)(v). This event is also reportable under the provisions of 10CFR50.73(a)(2)(vii) because a single condition caused the three subsystems of the emergency diesel generator HVAC system to become inoperable. Finally, due to the previously unrecognized potential for the diesel generators to be rendered inoperable from the effects of high temperature on required equipment in the diesel generator rooms (when outside air temperatures exceed levels that are not improbably

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high), this event is also reportable under the provisions of 10CFR50.73(a)(2)(i)(B) as a condition or operation prohibited by the Plant Technical Specifications. This is based on the fact that, to date, there have been many occasions or periods of time when outside air temperatures exceeded 91 degrees F. During those times, all three diesel generators were inoperable (but were not declared inoperable since the condition was unknown). Having three diesel generators inoperable at the same time requires entry into Technical Specification (TS) 3.0.3. A condition or operation requiring entry into TS 3.0.3 constitutes a condition or operation prohibited by the plant Technical Specifications.

An assessment of the safety consequences and implications of this event identified that this event has potential nuclear safety significance. The failure of the diesel generator room ventilation subsystems to perform their design functions during outside high air temperature extremes could cause common mode failure of the divisional emergency diesel generators to perform their functions of supplying sufficient power to safety-related equipment. Specifically, extremely high outside air temperatures could increase the diesel generator room temperature to above the design limits and cause a power supply failure and subsequent trip of the DC main feed circuit breaker to the diesel generator control panel. A loss of power to the control panel could prevent the diesel generator from performing its design function.

## ADDITIONAL INFORMATION

No equipment or components failed as a result of this event.

Clinton Power Station has not reported similar events regarding inadequate HVAC design and failure to provide proper Class 1E electrical isolation in recent history.

For further information regarding this event, contact M. M. Gandhi, Engineering Projects Engineer, at (217) 935-8881, extension 4062.

10CFR21 Report 21-97-036

On July 24, 1997, during investigation of condition report (CR) 1-97-06-302 which identified an issue involving increased Diesel Generator Room Heating, Ventilating, and Air Conditioning system fan horsepower consumption at low temperature and the effect on diesel generator loading and electrical load distribution system, questions were raised about the design of the HVAC system. These questions resulted in an evaluation of the DG ventilation system for adequacy during extreme high and low outside ambient air temperatures. Due to design limitations on the diesel generator room ventilation subsystems, it was determined adequate cooling capacity may not be available to support operability of the diesel generators if outside temperatures exceed levels that are not improbably high for the summer season. This issue was determined to be potentially reportable under 10CFR21. IP has completed an evaluation of this issue and concludes that it is reportable under the provisions of 10CFR, Part 21.

IP is providing the following information in accordance with 10CFR21.21(c)(4). Initial notification of this matter will be provided by facsimile of this letter to the NRC Operations Center in accordance with 10CFR21.21(c)(3) within 2 days of the date the responsible officer approves this report.



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- (i) Wayne D. Romberg, Assistant Vice President of Illinois Power Company, Clinton Power Station, Highway 54, 6 Miles East, Clinton, Illinois, 61727, is informing the NRC of a condition reportable under the provisions of 10CFR21 by means of this report.
- (ii) The basic component involved in this report is the design of the diesel generator room ventilation subsystems.
- (iii) The design for the diesel generator room cooling subsystems was supplied by Sargent & Lundy.
- (iv) As discussed in the DESCRIPTION OF EVENT portion of this report, the nature of the defect is the diesel generator room ventilation subsystems are not designed to address the temperature extremes of the area surrounding CPS and may not perform their design functions during those extremes.
- As discussed in the ANALYSIS OF EVENT portion of this report, failure of the ventilation subsystems to perform their design functions during temperature extremes could cause failure of the diesel generators to perform their functions of supplying sufficient power to safety-related equipment.
- (v) On July 24, 1997, IP identified that the diesel generator room ventilation subsystems may not be designed to include the temperature extremes of the area surrounding CPS and IP determined that this issue was potentially reportable under 10CFR21.
- (vi) This issue affects the design of the diesel generator room ventilation subsystems for the Divisions 1, 2, and 3 emergency diesel generators. IP is not aware of other facilities that would be affected by this issue.
- (vii) The corrective action that IP is taking for this event is discussed in the CORRECTIVE ACTION section of this report.
- (viii) IP has no additional information to offer.