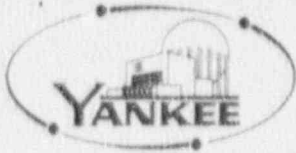


# YANKEE ATOMIC ELECTRIC COMPANY

Telephone (413) 424-5261



Star Route, Rowe, Massachusetts 01367

November 28, 1990  
BYR 90-135

TO: NRC - DOCUMENT CONTROL DESK  
DOCUMENT: LICENSEE EVENT REPORT, LER  
EXCEPTIONS: SEND ORIGINAL COPY

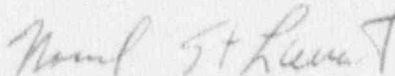
U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555

Subject: Licensee Event Report No. 50-29/90-06, Rev. 1  
Emergency diesel Generators Failed T.S.  
Surveillance Test

Dear Sir:

In accordance with 10 CFR 50.73(a)(2)(ii) the attached Licensee Event Report is hereby submitted. This revision contains supplemental information not available when this LER was first issued.

Very truly yours,

  
Normand St. Laurent  
Plant Superintendent

RAR/pkg  
Enclosure

cc: [3] NSARC Chairman (YAEC)  
[1] Institute of Nuclear Power Operations (INPO)  
[1] USNRC, Region I  
[1] Resident Inspector

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Yankee Nuclear Power Station, Rowe, Ma. 01367	DOCKET NUMBER (2) 0 5 0 0 0 0 0 2 9	PAGE (3) 1 OF 0 5
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TITLE (4)  
Emergency Diesel Generators Failed T.S. Surveillance Test

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 NAMES		DOCKET NUMBER(S)
0 8	1 1	9 0	9 0	0 0 6		0 1	1 2	8 9 0			0 5 0 0 0
											0 5 0 0 0

OPERATING MODE (9) 5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §. (Check one or more of the following) (11)					
POWER LEVEL (10) 0 0 0	20.402(b)		20.406(e)		50.73(a)(2)(iv)	73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)	73.71(e)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vi)	OTHER (Specify in Abstract 362(c) and in Text, NRC Form 366A)
	20.405(a)(1)(iii)		50.73(e)(2)(i)		50.73(a)(2)(vii)(A)	
	20.405(a)(1)(iv)		X 50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)	
20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(ix)		

LICENSEE CONTACT FOR THIS LER (12)

NAME Gregory A. Maret, Technical Director	TELEPHONE NUMBER
	AREA CODE: 4 1 3 4 2 4 - 1 5 2 6 1 1

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRRDS
B	E	K D G	G 1 0 0						

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)  NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e. approximately fifteen single space typewritten lines) (16)

On August 10, 1990 at 1700 hours, while in Mode 5 during a refueling shutdown, all three plant Emergency Diesel Generators (EDGs) were conservatively called inoperable, but available for service, while awaiting results of post maintenance testing being conducted on EDGs No.s 1 and 2. The action statements for TS 3.8.1.2 and 3.8.2.2 were entered and actions to suspend core alterations or positive reactivity changes, and establish refueling containment integrity were taken. Surveillance testing conducted on Aug. 11, 1990 at 0200 hours, confirmed that EDG No. 2 could not meet the TS acceptance criteria. Testing of EDG No. 3 also verified its inability to meet TS acceptance criteria.

An independent investigation team reviewed the plant's EDG testing history (including the acceptance criteria) to determine root cause and safety consequences, and to recommend short/long term corrective actions. In addition, all three EDGs have been replaced with new units having a design rating of 600 kw standby, and 450 kw continuous.

At no time was the health and safety of the public adversely impacted. An analysis of the event indicates that at all times the EDGs were capable of performing their intended safety function.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
			0 0   6	0 1	0 2	OF 0 5

TEXT (If more space is required, use additional NRC Form 365A's) (17)

## EVENT DESCRIPTION

In August 1990, with the plant in Mode 5 during a refueling outage, all three Emergency Diesel Generators (EDGs) [EHS:DG] were undergoing 10-month surveillance load testing following overhaul and preventative maintenance. This test is required by the plant Technical Specifications (TS 4.8.1.1.2.d.4) at refueling intervals.

On August 2, 1990, at 2200 hours, EDG No. 3 was tested and declared inoperable due to its failure to meet the acceptance criteria contained in Plant Procedure DP-4209; specifically, EDG No. 3 could not hold greater than or equal to 400 kw for greater than or equal to one hour. At the time of this initial test, failure of EDG No. 3 to pass this surveillance test was not considered a violation of TS. The TS requires only one EDG to be operable in Mode 5.

On August 10, 1990 at 1700 hours, all three plant EDGs were conservatively called inoperable, but available for service, while awaiting results of post maintenance testing being conducted on EDGs Nos. 1 and 2. The action statements for TS 3.8.1.2 and 3.8.2.2 were entered and actions to suspend core alterations or positive reactivity changes, and establish refueling containment integrity were taken. On August 11, 1990 at 0200 hours, surveillance testing confirmed that EDG No. 2 also could not meet the acceptance criteria. The failure of these EDGs suggested the possibility of a common mode failure mechanism.

On August 12, 1990 at 1700 hours, it was postulated that an unanalyzed condition might exist at Yankee Nuclear Power Station (YNPS) in regard to the EDGs capability to meet ECCS power needs. To determine if an unanalyzed condition did exist, the President of Yankee Atomic Electric Company (YAEC) requested that an independent team evaluate the concern. This independent team, reporting through the Yankee Nuclear Safety Audit and Review Committee (NSARC), was chartered to look at: a) the plant's capability to respond to a loss of offsite power during Mode 5, b) safety consequences of this event, c) testing history (including test acceptance criteria), d) root cause of the event, and e) short/long term corrective action recommendations. This LER contains the results of this evaluation.

## CAUSE OF THE EVENT

The condition that led to discovery of this event can be attributed to the effect of high ambient temperature, present during EDG surveillance testing (previous surveillance tests have been conducted at significantly lower ambient temperatures). Had the 1990 surveillance tests been conducted at lower ambient temperatures, the acceptance criteria would more than likely have been met and the primary problem of undersized EDGs would have gone undetected.

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

The root cause of this event can be attributed to the diesel engine being undersized to adequately power the generator at rated load at YNPS design basis temperatures. Several factors contributed to this event:

1. Erroneous assumption of output rating: When YNPS purchased these used EDGs in 1969 they were thought to be capable of producing 400 kw within the temperature range of 35 degrees F and 110 degrees F. However, as the original EDG design specification stated that load tests were not required at the time the EDGs were purchased from the supplier, no documentation came with the EDGs to verify their output capability.

The manufacturer was recently contacted to try to locate the results of any tests they may have run prior to selling the EDGs. YNPS learned that the manufacturer only held records for five years, so no test records were available.

A recent calculation determined that the EDGs power output, at the time of installation at YNPS, probably ranged between 359 kw and 399 kw. These values are based on: the industry standard (SAE J8 16) used to rate this diesel engine at the time of manufacture (1965), the manufacturer's acceptance tolerance for testing, accounting for auxiliary loads, and generator efficiency.

2. Lack of adequate acceptance testing: Tests were conducted on the EDGs at the time they were installed at YNPS. These tests took place during December 1969 when the ambient temperature ranged from 18 degrees F to 40 degrees F. The limited information that can be gained from these tests today indicates the EDGs may have had trouble meeting the 400 kw loading criteria at the time of initial installation.
3. Erroneous substitution of kva for kw as acceptance criteria: The diesel engines were received without a nameplate rating. The generators have a nameplate rating of 400 kw, 500 kva @ 0.8 pf.

During a one-time, 24-hour test (in response to I&E Bulletin 79-23), EDG No. 1 could not maintain 400 kw for the duration of the test. The acceptance criteria was then changed to allow "greater than or equal to 400 kw or greater than or equal to 500 kva for 24 hours," under the mistaken assumption that kw and kva were interchangeable. The effect of power factor on this relationship was apparently not well understood. This change in acceptance criteria masked the undersizing problem until the error was discovered in 1988 during a revision of DP-4209 (This error was documented in LER 88-01).

Even when kw was again used as acceptance criteria (1988), the EDC undersizing problem was masked by the low ambient temperatures (14 to 16 degrees F) present during testing. It was not until August of 1990, with



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

ambient temperatures higher than those previously encountered during surveillance testing, that the undersizing problem became apparent.

## SAFETY ASSESSMENT

At no time was the health and safety of the public adversely impacted.

A review of all design basis accidents requiring ECCS operation demonstrated that if the EDGs had been required to operate under design basis ambient temperature conditions to mitigate an accident during a loss of off-site power, the EDGs could have satisfied their safety function.

## CORRECTIVE ACTION

Short term corrective actions (taken during August 2, 1990 to August 12, 1990) consisted of Maintenance Department personnel working with the vendor representative to determine if there was a maintenance-related reason for the EDGs not meeting TS acceptance criteria. Maintenance-related reasons and sub-component problems were ruled out. This led to the declaration of all three EDGs being inoperable. The TS Action Statement was entered, which required the establishment of refueling containment integrity, and suspension of core alterations or positive reactivity changes. At least two EDGs remained available to provide Mode 5 emergency loads, if needed (one EDG could have supplied all necessary Mode 5 loads).

Long term corrective action has consisted of replacing the existing three EDGs engines and generators with new ones having a higher continuous output rating. These units have a design (standby) rating of 600 kw, with a continuous rating of 450 kw. (The 450 kw continuous rating provides a minimum capacity margin of 14 percent above that required for ECCS pump loads.)

The new EDGs underwent extensive acceptance testing to ensure each meets its required load. This replacement effort has been completed, with all three new EDGs having been declared operable per TS.

The following additional long term corrective actions will be taken:

1. Yankee engineering will review surveillance procedures used for Technical Specification surveillances and all Inservice Testing Program procedures used for equipment surveillance to ensure that the acceptance criteria verify the capability of the equipment to meet the design basis operability requirements. The results of this surveillance testing will also be reviewed on an ongoing basis to ensure that any long-term trends are identified for prompt resolution.
2. Specific training will be given to all maintenance and operations personnel stressing the importance of establishing post-maintenance testing that demonstrates equipment operability. It will also be stressed that using an

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

approved surveillance procedure does not remove the requirement that the post-maintenance testing must demonstrate equipment operability. This event will be used during this training.