NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MN88 7714), 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

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Limerick Generating Station, Unit 1	05000 352	1 OF 7

TITLE (4) Potential Loss of Emergency Diesel Generator Control in the Event of a Fire due to Fire-induced Damage to Unprotected Voltage and Speed Control Cables

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	11	98	98	-- 018 --	0	10	09	98	Limerick, Unit 2	05000353
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)	x	OTHER
	20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
	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)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
T. A. Moore, Manager - Experience Assessment, LGS	(610) 718-3400

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 (If yes, complete EXPECTED SUBMISSION DATE).	X NO				

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

On 9/11/98, a review associated with the Thermo-Lag reduction project determined that local emergency diesel generator (EDG) control may not be available to support Safe Shutdown (SSD) of the plant in the event of a fire due to fire-induced damage to unprotected speed and voltage control cables. An assumption in the original (pre-Unit 1 licensing) SSD analysis took credit for transfer to local control stations, prior to the occurrence of fire-induced damage. Following the issuance of Information Notice 85-09, the SSD analysis was reviewed and modifications were implemented to address "damage before transfer" concerns. However, the subsequent SSD evaluations failed to recognize the potential impact of fire damage to the voltage and speed control circuits for three out of eight EDGs. This resulted in a failure to maintain the provisions of the Fire Protection Program (FPP) and is a violation of License Condition 2.C.(3) for both units. Therefore, this report is being submitted in accordance with License Conditions 2.F and 2.E for Units 1 and 2, respectively, and 10CFR50.73(a)(2)(ii)(B) as a condition that is outside the design basis of the plant. The potential consequences of this event are minimized by other permanent design and administrative features of the FPP. Compensatory measures are in place, and a modification that assures the availability of the EDGs will be implemented.

Unit Conditions Prior To The Event

Units 1 and 2 were in various Operational Conditions prior to the event. There were no other systems, structures, or components that were inoperable that contributed to the event.

Description Of The Event

On September 11, 1998, an engineering evaluation associated with the Thermo-lag reduction project determined that local emergency diesel generator (EIIS:EK, EDG) control may not be available to support Safe Shutdown (SSD) of the plant in the event of a fire due to fire-induced damage to speed and voltage control cables (EIIS:CBL1) which are not protected for certain fires in the Control Structure and the Unit 2 Reactor Building. Since sacrificial fuses are not currently part of the control circuits, a fire-induced hot short prior to transfer to local control of the D11, D21, and D22 EDGs (EIIS:DG) has the potential to blow control power fuses that could disable the voltage regulator, governor control, field flashing, and interlocks for connecting the EDGs to their respective switchgear. This would result in the unavailability of these EDGs to support Safe Shutdown (SSD) Method R in the control room and cable spreading rooms, and SSD Methods B and D in two other fire areas in the Unit 2 reactor building, i.e., Fire Areas 67W, the Unit 2 Safeguard System Access Area, and Fire Area 68W, the Unit 2 Control Rod Drive (CRD) Hydraulic Control Unit (HCU) Area. In addition, positioning the local/remote control transfer switch to the local position does not disconnect the negatives of these circuits from fire areas of concern. Therefore, even if a hot short did not occur prior to transfer, a hot short on the negatives of these circuits after transfer could blow control power fuses while operating the EDG from the local control station.

Engineering personnel evaluated the significance of this issue upon its discovery and immediately contacted station personnel to implement appropriate compensatory measures. Station personnel verified that the cable spreading rooms, and Fire Areas 67W and 68W, were already included on the hourly fire watch patrol rounds. The list of fire protection system impairments was revised to include this non-conforming issue.

This condition resulted in a failure to maintain the provisions of the approved Fire Protection Program as described in the Limerick Generating Station (LGS) Updated Final Safety Analysis Report (UFSAR) and is a

violation of Facility Operating License Condition 2.C.(3) for the LGS, Units 1 and 2. In addition, this condition is outside the design basis of the plant. Accordingly, at 1759 hours on September 11, 1998, a 1-hour notification was made to the NRC in accordance with the requirements of 10CFR50.72(b)(2)(ii)(B). This notification also satisfied the 24-hour notification requirements of License Condition 2.F and 2.E for Units 1 and 2, respectively. This report is being submitted in accordance with 10CFR50.73(a)(2)(ii)(B) and License Conditions 2.F and 2.E for Units 1 and 2, respectively.

Consequences Of The Event

The actual consequences for this condition are minimal since a fire challenging the fire protection program or requiring the safe shutdown of either unit did not occur. The potential for a fire and the impact of a fire in the Main Control Room, the Unit 1 and Unit 2 Cable Spreading Rooms, the Unit 2 Safeguard System Access Area and the Unit 2 CRD HCU Area is minimized by a combination of many factors. The design of the Fire Protection Program relies on a 'defense-in-depth' approach which serves to: prevent a fire from starting, quickly detect and suppress fires which do start, provide reasonable electrical isolation and separation of circuits to minimize the plant system challenge of fires prior to detection and suppression, prevent the rapid spread of fires by selecting fire retardant construction materials, and protect safety related equipment so that a fire will not prevent SSD of the plant.

The potential for a fire and the consequences of postulated fire damage in the specific areas of concern are further mitigated by the following factors.

Automatic fire detection is provided in all five (5) fire areas and suppression equipment exists in all five areas as outlined below:

- the Main Control Room is continually manned and provided with manual fire suppression equipment,
- the Cable Spreading Rooms are protected by an automatic pre-action sprinkler system and are provided with manual fire suppression equipment, and
- the Unit 2 Safeguard System Access Area and Unit 2 CRD HCU Area are provided with manual fire suppression equipment.

Divisional separation of equipment and cabling associated with independent trains of SSD equipment per the design reduces the likelihood of damage to redundant trains of equipment in these areas.

Transient combustibles and fire hazards within these areas are controlled through strict administrative procedures. These areas are currently provided with an existing hourly fire watch patrol in the Cable Spreading Rooms, the Unit 2 Safeguard System Access Area, and the Unit 2 CRD HCU Area. The use of an hourly fire watch patrol is consistent with the defense-in-depth philosophy in the Branch Technical Position (BTP) CMEB 9.5.1, the LGS Technical Requirements Manual (TRM), and commitments associated with the inoperable Thermo-Lag fire barriers.

The Cable Spreading Rooms are controlled such that no transient combustible materials are permitted in the areas without compensatory measures.

The Unit 2 Safeguard System Access Area and the Unit 2 CRD HCU Area are controlled such that the use and storage of combustibles is not permitted in the vicinity of electrical raceways and components.

As an interim corrective action, a Shift Night Order (SNO) was issued to alert operators that fire induced faults on diesel generator voltage and speed control circuits may result in blown control power fuses, which may prevent the diesel from starting or achieving rated voltage. The SNO identified that troubleshooting may be required to operate the diesel(s) in the event of these fire induced circuit faults. The specific fire areas, diesel generators and Fire Safe Shutdown Procedures were identified.

The combination of these factors also provides the basis for the adequacy of the interim compensatory actions taken for this discovered condition (i.e., hourly fire watch patrol, control of transient combustible materials, and the notification of the licensed operators.)

Cause Of The Event

The cause of this event was less than adequate implementation of design requirements. The original LGS fire SSD analysis, prior to issuance of the Unit 1 Operating License in 1984, assumed that all diesel generators would be controlled at the local diesel generator

control stations. This was consistent with the LGS analysis practice to minimize the number of cables that were designated as required to support SSD. Rationale for exclusion or inclusion of individual cables was not documented. The cables associated with this deficiency were not identified as required for SSD. It is believed that the potential for fire damage before transfer was not identified as a concern, and therefore, was not evaluated at this time.

Information Notice (IN) 85-09 identified the potential for fire damage to occur to control and control power circuits, prior to isolating circuits subject to fire damage at local control stations. The specific concern was the potential for the blowing of the only control power fuses for hot shutdown equipment. The operability of hot shutdown systems, including the ability to overcome fire induced damage and mispositioning of hot shutdown equipment and the supporting power distribution system, must exist without repairs, including replacement of fuses. Documentation for both the 1985 and 1988 reviews of applicability of IN 85-09 to the LGS SSD analysis only addresses the start and stop circuits for diesel generator control. As a result, modifications were made to the diesel generator start and stop control circuits, only. No documentation could be located for the acceptability or the failure of the diesel generator voltage and speed control circuits. At the time, i.e., pre-Unit 2 licensing, the cables associated with this deficiency were incorrectly not identified as required for SSD. The lack of documentation for exclusion of these cables was consistent with LGS SSD analysis practices (i.e., minimizing the number of cables designated as required to support SSD.)

The LGS SSD analysis was re-verified in 1991 and 1992. This verification effort changed the SSD analysis and cable inclusion philosophy. This approach maximized the inclusion of cables for analysis. The analysis subsequently evaluated and documented the acceptability of cable failures on a fire area by fire area basis. The diesel generator cables associated with this deficiency are included in this SSD analysis. The verification effort correctly concluded that post-fire SSD did not require the "function" of this cable (i.e., remote control of diesel generator voltage and speed). However, there is no documented evaluation of the acceptability of potential fire damage before transfer and its effects on control power, or fire-induced faults which may affect the circuit after transfer.

A contributing factor to the identified condition was that the original fire SSD analysis and SSD cable selection analysis were not well documented due to the practice of minimizing cables identified as required for post-fire SSD.

Corrective Actions

NCR 98-02422 was generated to disposition the identified deficiencies in the fire SSD design. A modification that assures availability of control power and isolation from potential fire damage will be implemented by the end of the 1999 Unit 2 refueling outage.

A review will be performed to assess for potential generic implications. This deficiency was associated with fire-induced damage to diesel generator control circuits, occurring prior to transfer to local control stations. The damage before transfer could disable local control of the diesel generators. Transfer to local control locations did not necessarily provide isolation from cables routed in remote fire areas. This generic implications review will include:

- review of other diesel generator circuits for the potential to disable diesel generator controls by:
  - damage prior to transfer
  - lack of circuit isolation from potential fire damage, or
  - damage not associated with transfer from remote to local control stations.

- review of selected circuits associated with transfer to other local control stations.

These reviews will be completed by November 15, 1998.

This issue was identified during the Thermo-Lag reduction project. The project includes documenting SSD analysis assumptions and calculations supporting the revised plant wide SSD re-analysis supporting Thermo-Lag reduction modifications. Numerous SSD assumptions, analyses, and calculations are being re-verified as part of this project.

Previous Similar Occurrences

LER 1-88-031, Rev. 2, reported a condition outside the design basis of the plant and a violation License Condition 2.C.(3) for LGS, Unit 1, due to fire safe shutdown concerns. Actions performed as a result of LER 1-88-031 and other subsequent related LERs included a study to verify basic compliance for various SSD issues, including "Fire Damage Prior to Transfer." This study was the basis for the modifications that were performed to the diesel generator start and stop circuits but failed to recognize the potential damage to the voltage and speed control circuits.

There have been several subsequent LERs that reported non-conformances with the fire SSD analysis (e.g., 1-96-012, 1-96-015, 1-96-021). These issues were also identified during the Thermo-Lag reduction project but did not involve the potential for fire-induced damage before transfer of control to local control stations, nor did they involve errors with cable analysis. The previous corrective actions for fire SSD deficiencies did not address incorrect assumptions in the original SSD analysis, and therefore, would not have identified and corrected the non-conformance identified in this report.