

LICENSEE EVENT REPORT (LER)

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

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 (MNBB 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.

FACILITY NAME (1) Indian Point Unit 3	DOCKET NUMBER (2) 05000286	PAGE (3) 1 of 8
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TITLE (4) Less than the required number of Emergency Diesel Generators were Operable Due to Loss of Ventilation resulting from an Inadvertent Operation of a Carbon Dioxide System: A Condition Prohibited By Technical Specifications

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
06	18	97	97	--010--	01	10	14	97	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9) N	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)			
POWER LEVEL (10) 000	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)		OTHER			
	20.405(a)(1)(iii)	✓	50.73(a)(2)(i)		50.73(a)(2)(vii)		(Specify in Abstract below and in Text, NRC Form 366A)			
	20.405(a)(1)(iv)	✓	50.73(a)(2)(ii)		50.73(a)(2)(vii)					
	20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)					

LICENSEE CONTACT FOR THIS LER (12)

NAME Steve Wilkie, Fire Protection Engineer	TELEPHONE NUMBER (Include Area Code) (914) 736-6143
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CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

YES (If yes, complete EXPECTED SUBMISSION DATE).	✓	NO	EXPECTED SUBMISSION DATE (15)			
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On June 18, 1997 at approximately 0845 hours with the plant in cold shutdown and the 31 Emergency Diesel Generator (EDG) inoperable for maintenance, Operations concluded 32 Emergency Diesel Generator (EDG) was inoperable. This resulted in less than the required number of EDGs operable; a condition prohibited by Technical Specifications. The inoperability of 32 EDG was based on the loss of 32 EDG room ventilation. The loss of 32 EDG room ventilation was caused by inadvertent operation of the carbon dioxide (CO2) system provided for 32 EDG room. This did not result in a CO2 discharge. Lack of ventilation could have allowed the temperature to exceed design temperature in 32 EDG room if 32 EDG had started. 32 EDG would have operated reliably until room temperature exceeded equipment qualification temperature of 126 degrees Fahrenheit. EDG combustion air is supplied by a snorkel to ensure continued operation of the EDGs with a fire in the associated diesel room. Subsequent investigation determined that all three EDGs could be susceptible to a similar failure due to inadvertent operation of a similar relay in each of the other EDG CO2 panels during an earthquake. A four hour report was made to the NRC pursuant to 10 CFR 50.72 (b)(2)(iii)(A) at 2212 hours on July 2, 1997. The cause of this failure was personal error due to inadequate failure and effects analysis for the 1980 modification that installed the CO2 system. Corrective actions included restoration of 32 EDG room ventilation to establish operability of 32 EDG. Further corrective actions included isolation of power to the CO2 actuation circuitry that initiates isolation of the EDG ventilation systems, isolation of CO2 supply and posting of continuous fire watch personnel in accordance with the fire protection Operational Specifications. This event had no effect on the health and safety of the public.

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Note: The Energy Industry Identification System Codes are identified within the brackets { }

DESCRIPTION OF EVENT

On June 18, 1997, at approximately 0845 hours with 31 Emergency Diesel Generator (EDG) {EK} inoperable for maintenance a Nuclear Plant Operator (NPO) inadvertently caused a portion of the fire protection CO2 System {LW} to actuate the electro-thermal links on 32 EDG smoke dampers which isolated ventilation to the 32 EDG. There was no CO2 discharge and the CO2 header was not pressurized. Operations declared 32 EDG inoperable in accordance with procedures when the ventilation system is inoperable. With less than two EDGs operable the plant was in a condition prohibited by Technical Specification 3.7.F.4. Limiting conditions for operation (LCOs) were entered to track the operability status of 32 EDG and the CO2 System. Operability of 32 EDG was restored at 0930 hours when doors D8 (31 EDG to EDG building vestibule) and D9 (31 EDG to 32 EDG) were blocked open to provide ventilation. Continuous fire watches were posted in accordance with the fire protection Operational Specifications. The LCOs were exited, doors D8 and D9 were closed and the fire watches were secured after the electro-thermal links were replaced at 1230 hours. This event was documented in Deviation Event Report (DER) 97-1424.

The event occurred while an NPO was removing a CO2 System relay box cover to accommodate an inspection of the box contents. During removal, the relay box cover accidentally fell and hit 32 EDG CO2 control panel. Engineering analysis concluded that, when the cover hit 32 EDG CO2 control panel it caused either the 2-3 contact of the RH1 relay to close momentarily or a momentary short between terminals 2 and 3 on the RH1 relay socket. Either of these conditions could energize the LR1 and LR2 relays without holding the RH1 relay energized. Energizing the LR1 and LR2 relays results in melting of the electro-thermal links on 32 EDG smoke dampers (FP-DS-53 and 54), stopping of 32 EDG exhaust fans (exhaust fan 316 and 317) and activation of several alarms (i.e., CO2 SYSTEM ACTUATED alarm on 32 EDG CO2 control panel, ALARM CIRCUIT TROUBLE alarms on 31 and 33 EDG CO2 control panels, CO2 SYS PWR FAIL alarms for diesel generator rooms 31 and 33 in the control room, and Common CO2 ACTUATED audible alarm in the control room).

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During investigation of the cause of this event, the potential was identified for a common cause to initiate the fire protection circuits for all three EDGs causing CO2 discharge, isolation of ventilation or both to occur. A seismic event or seismic interaction could cause this since the cabinets are not seismic class I and are located in the non-seismic turbine building. Other potential initiators (e.g., high energy line break, tornado) were not evaluated as part of the design. Because the identified common mode failures could potentially result in the inoperability of all three EDGs, the potential failure was documented in DER 97-1590 and reported in a 4 hour ENS notification at approximately 2212 hours on July 2, 1997. Additional corrective actions taken were; power was isolated from relays that initiate isolation of EDG room ventilation, CO2 was isolated and continuous fire watches were posted in accordance with fire protection Operational Specifications.

The potential for the common cause failure causing a loss of EDGs was previously identified but inadequately evaluated in DER 95-0397. Additionally as a result of an evaluation of the susceptibility of the heating, ventilation and air conditioning systems to single failure, LER 95-003 identified the potential for single failure to cause inadvertent operation of the CO2 system of the 480v Switchgear room. The evaluation focused on a single failure of a component in a system interconnected to the ventilation system. The EDGs are bounded by a single failure analysis. The extent of condition evaluation did not recognize the loss of all three EDGs due to a common cause. The potential for fire induced hot shorts to cause inadvertent CO2 system actuation in the 480 volt switchgear and cable spreading rooms as well as in all three EDG cells was identified in LER 95-006. The evaluation focused on fire as a cause. Corrective actions in the LER 95-006 response provided for procedural guidance to restore ventilation to the EDG rooms after a fire. Since these procedures were not intended to address loss of ventilation in non-fire scenarios they provided a weak link for ventilation restoration after inadvertent CO2 system actuation. This contributed to untimely restoration of 32 EDG ventilation system following the event of June 18, 1997.

CAUSE OF EVENT

This event was caused by personnel error due to inadequate failure and effects analysis for the 1980 modification that installed the CO2 system. This is attributed to a lack of understanding at that time of plant ventilation systems support role to safety related systems.

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CORRECTIVE ACTIONS

The following corrective actions have been or will be performed to address the causes of this event:

- Ventilation of 32 EDG room was re-established to establish operability of 32 EDG.
- Power was isolated from relays that initiate isolation of EDG room ventilation, CO2 was isolated and continuous fire watches were posted in accordance with plant Operational Specifications.
- A review of the CO2 systems protecting the 480 volt switchgear and the cable spreading room has been determined not to have an adverse effect on safety systems located within these areas as a result of an inadvertent actuation.
- A review of non-seismic CO2 panels determined that the ability to provide cooling by other ventilation systems would not be impacted.
- A field test to measure the actual diesel generator heatup rate will be conducted to compare against the conservatively calculated heatup rate. To be completed by December 19, 1997.
- Alarm Response Procedure ARP 15, "Panel SMF-Safety Injection" and ARP-27, "Fire Display Control Panel" will be enhanced to address system interlocks and subsequent actions if expected initial conditions such as a fire do not occur. To be completed by December 19, 1997.
- A seismically qualified auxiliary control panel will be installed for the CO2 systems to prevent inadvertent operation from seismic, tornado generated missiles or adverse environment interactions. To be completed by May 15, 1998.
- The fire protection system will be reviewed to ensure that there are no system interlocks with safety related systems which could adversely affect the function of that safety related system or component. To be completed by March 2, 1998.
- Plant ventilation systems which provide a support function to safety related systems and components will be reviewed to ensure that no interlocks exist which could adversely affect the function of the safety related systems or components. To be completed by April 17, 1998.
- A case study will be developed by the Training Department and added to the 1997 Engineering Support Personnel continuing training on performing failure and effects analysis for plant modifications including a discussion on LER 97-010. To be completed by December 19, 1997.

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- Since the 1980 CO2 modification, a more comprehensive modification and design control process has been put in place, including issuance of procedures, to improve the design and review of modifications. Additional improvements to the design and modification process have been made since the issuance of these procedures. The Authority believes the current modification and design control process should prevent the type of design error that occurred with the CO2 system.
- Improvements have been made to the corrective actions program since 1995. The Authority believes that the DER investigation and resolution process should by itself be adequate. However additional barriers have been added, including establishing a DER review committee (a diverse group reviewing the closure of DERs of similar significance), and review of select DERs by the Plant Leadership Team. The Authority believes that these improvements should provide additional assurance to prevent missed opportunities similar to those identified with the CO2 system.

ANALYSIS OF EVENT

The inadvertent operation of the CO2 System is being reported under 10 CFR 50.73 (a) (2) (i) (B). The licensee shall report any operation or condition prohibited by the plant's Technical Specifications. The condition is being reported because TS 3.7.F.4 requires two EDGs to be operable under all conditions including cold shutdown. 31 EDG was inoperable due to the performance of preventive maintenance. The declaration of inoperability of 32 EDG resulted in two EDGs being inoperable for 45 minutes.

During the investigation of this event a subsequent report was made under 10 CFR 50.72(b) (2) (iii) (A). This event is also reportable under 50.73 (a) (2) (v). The licensee shall report any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe condition. This event is also being reported under 10 CFR 50.73 (a) (2) (ii) (B). The licensee shall report any event or condition that results in placing the facility outside its design basis. The common cause failure of the EDG ventilation system caused by inadvertent operation of the CO2 system would have potentially resulted in the inability of each EDG to perform its intended design function. This is based on the conservative assumption of reaching the limiting equipment qualification temperature of 126 degrees F of the diesel generator room in approximately 5 minutes due to the difficulty in quantifying a heat loss rate from the diesel engine and generator at the initial stages of engine startup.

Based on further review, the criteria under 10 CFR 50.73 (a) (2) (vii) (A) is not applicable because this event only caused one of the three EDG to be inoperable when the relay box cover hit the 32 EDG CO2 control panel.

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A review of Licensee Event Reports (LERs) over the last two and one half years for similar events concerning inadequate design identified the following LERs :LER 97-006, 97-003, 96-004, 95-006, 95-003.

SAFETY SIGNIFICANCE

This event did not have an effect on the health and safety of the public. There was no actual safety significance because there was no actual seismic event, tornado or adverse environment condition which caused a common mode failure affecting operability of the EDGs and there was no demand for the EDGs when the 32 EDG was declared inoperable.

The potential safety significance was assessed assuming a common cause event resulting in inadvertent operation of the CO2 circuitry while in power operation concurrent with a loss of offsite power. The event (i.e. loss of ventilation leading to loss of EDGs) could be mitigated if the operability of the EDG ventilation systems could be restored through manual action or if an alternate power supply were available.

The re-establishment of the ventilation in any one or all diesel generator rooms is estimated to be accomplished in about 15 minutes by opening the CO2 system interlock breaker located at lighting panel LP-323 and manually blocking open the smoke dampers which provide supply air to the rooms. The 15 minute duration considers the potential need for donning a self contained breathing apparatus (SCBA) to enter a CO2 environment. All fire brigade members which include operations staff are trained in the use of SCBA.

Based on an engineering calculation, the time period for a diesel generator room to heatup to the limiting equipment qualification temperature of 126 degrees F is approximately five minutes. Due to the difficulty in quantifying a heat loss rate from the diesel engine and generator at the initial stages of engine startup, a conservative assumption was made to account for the heat contribution.

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Combustion air to each diesel engine is supplied via a piping arrangement (e.g., snorkel) which is routed through an intake plenum. Smoke dampers in the supply ducts between the intake plenum and the room allow isolation of the room without isolating the combustion air intake. The inadvertent operation of the CO2 systems with or without closure of the smoke dampers has been determined based on engineering judgement to not compromise the performance of the diesel engines. The ingestion of CO2 in the combustion air intakes is very unlikely because combustion air is supplied to each engine via a snorkel routed through the room up to the air intake plenum located approximately 25 feet above the room, leakage paths to outside the room from 24 inch and 8 inch drains at the floor elevation, and the configuration of the room. The CO2 pre-operational testing following the installation of the EDG CO2 systems and combustion air intake snorkels, provides reasonable additional assurance that the diesel engines can operate in a CO2 environment with or without smoke damper closure. This conclusion was based on documentation of a full CO2 system discharge test concurrent with EDG 31 running, in November of 1980, where one of the two smoke dampers failed to close. A review of the Operator Log during the test found no indication that the performance of the EDG was adversely affected. The effects on the diesel from one damper failing, or from both dampers failing, are not considered by engineering judgement to be materially different.

The atmospheric temperature of the diesel rooms is expected to drop to about minus 50 degrees F following a CO2 discharge into the rooms. The temperature drop is based on an empirical model simulation using limiting indoor and outdoor temperatures. Air temperature near or within the electrical switchgear is estimated to be approximately 40 degrees F and heatup following a CO2 discharge is expected to be rapid. The CO2 system protecting the diesel generator rooms are total flooding systems supplied by a 10 ton CO2 storage tank. Failure of the electric timers controlling the CO2 discharge into the diesel rooms could potentially discharge the 10 tons of CO2 causing the room atmospheric temperature to drop to approximately minus 110 degrees F. The temperature within the electrical switchgear is expected to be greater than minus 110 degrees F. Dry ice formation is not expected on the electrical switchgear cabinets due to the relatively long path of travel imposed on the dry ice particles during a CO2 discharge. The potential of dry ice formation will be reduced by the operation of the diesel engine due to the increase of the room atmospheric temperature. Condensation may occur as a result of CO2 discharge but is not expected to adversely affect the safety related function of the diesel generator. This is based on the pre-operational testing following the installation of the EDG CO2 systems where no adverse effects on performance or subsequent operation was noted. Additionally, there is no indication that overpressurization of the rooms would occur from a CO2 discharge based on inspection of existing vent area and leakage paths and review of the operator log and pre-operational test.

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The reported event identifies a common cause event which could potentially render the EDGs inoperable due to inadvertent operation of the EDG CO2 systems following a seismic event, tornado or adverse environmental condition. Procedures and equipment exist to safely shutdown the plant following plant design basis events using alternate power sources. The Appendix R diesel generator would provide an alternate power source for safe shutdown, when available. The Appendix R diesel generator is required to be operable per plant Operational Specifications which require an LCO to be entered when the diesel is out of service. The Appendix R diesel generator is designed to ensure safe shutdown following a postulated fire which disables all three EDGs and is credited for shutdown with a station blackout. The Consolidated Edison gas turbines are an additional source of backup power with control room procedures to supply power to the 13.8 Kv bus. Although the alternate diesel generator and the gas turbines are not seismically qualified, they are expected to survive a seismic event based on earthquake experience data developed by the Seismic Qualification Utility Group (SQUG) in addressing Unresolved Safety Issue A-46.