

Detroit
Edison

Douglas R. Gipson
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10CFR50.73

April 25, 1994
NRC-94-0025

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

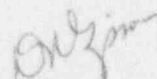
- References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43
- 2) NRC-94-0006, Licensing Event Report (LER) No.
93-014, dated January 24, 1994

Subject: Licensee Event Report (LER) No. 93-014, Revision 1

Please find enclosed LER No. 93-014, Revision 1, dated April 25, 1994, for a reportable event that occurred on December 25, 1993. A copy of this LER is also being sent to the Regional Administrator, USNRC Region III.

If you have any questions, please contact John A. Tibai, Principal Compliance Engineer, at (313) 586-4289.

Sincerely,

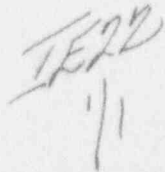


Enclosure: NRC Forms 366, 366A

cc: T. G. Colburn
J. B. Martin
M. P. Phillips
K. R. Riemer
P. L. Torpey

Wayne County Emergency
Management Division

9404290114 940425
PDR ADDCK 05000341
S PDR



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 (INRB 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)

Fermi 2

DOCKET NUMBER (2)

05000 341

PAGE (3)

1 OF 7

TITLE (4)

Automatic Reactor Shutdown Following Failure of the Main Turbine

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	25	93	93	014	01	04	25	94		05000
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	POWER LEVEL (10)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more) (11)				
1	93%	20.402(b)	20.405(c)	<input checked="" type="checkbox"/>	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)	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)	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

John A. Tibai, Compliance Engineer

TELEPHONE NUMBER (Include Area Code)

(313) 586-4289

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRCDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRCDS
B	TA	TRB	E275	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
<input checked="" type="checkbox"/>	<input type="checkbox"/>				

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

On December 25, 1993 at 1315 hours an automatic reactor shutdown occurred when the main turbine tripped off line. The turbine generator tripped when the mechanical overspeed device was activated. This was due to high vibration levels and was not due to an actual overspeed condition. The turbine generator unit and associated support systems sustained significant damage. All safety systems and isolations performed as designed during the event. An Unusual Event was declared at 1352 hours. This was upgraded to an Alert at 1357 hours. A fire at the main generator brush rig area was extinguished by the plant fire brigade using hand held extinguishers.

The cause of the high turbine vibration was due to the failure of the number 9 blade, on the 8th stage, turbine end of the low pressure section number 3. The root cause of this failure continues to be under investigation.

Turbine/generator repairs will be determined based on the results of the investigation. Other corrective actions needed to return the plant to power operation are being formulated and implemented.

REQUIRED NUMBER OF DIGITS/CHARACTERS
FOR EACH BLOCK

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

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

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FACILITY NAME (1)		DOCKET NUMBER (2)		LER NUMBER (6)			PAGE (3)
Fermi 2		05000 341		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 7
				93	- 014	- 01	

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

Initial Plant Conditions:

Operational Condition: 1 - Power Operation
Reactor Power: 93.5 Percent
Reactor Pressure: 1020 psig
Reactor Temperature: 535 degrees Fahrenheit

Description of Event:

On December 25, 1993 at 1315 hours an automatic reactor shutdown [JC] occurred in response to a main turbine [TA] trip. The specific cause of the reactor automatic shutdown was fast closure of the turbine control [JJ] valves. The main turbine generator [TB] tripped off line due to activation of the mechanical overspeed trip device. This was caused by very high vibration levels and not by an actual overspeed condition. Control room operators [Utility-Licensed] heard a loud noise from the turbine deck followed by heavy rumbling. A number of alarms were received in the control room [NA] including the seismic monitoring alarm, turbine vibration alarms [VA], turbine tripped alarm and alarms from turbine auxiliary systems. Control Room operators noted that the oil supply pressure to the main turbine indicated 0 psig.

Twenty five (25) seconds into the event the main steam isolation valves (MSIV)[ISV] automatically closed due to high condenser [SG] pressure (Group 1 isolation). A Group 13 isolation (Drywell Sumps) [WK] occurred when reactor water level decreased to level 3, which normally occurs during an automatic shutdown from power operation. Reactor pressure was controlled by manually opening safety relief valves [RV] and water level was controlled by manual operation of the reactor core isolation cooling (RCIC)[BN] and standby feedwater (SBFW)[SK] systems.

The Nuclear Shift Supervisor [Utility-Licensed] declared an Unusual Event at 1352 hours based on fire alarms and potential fire hazards from turbine lubricating oil. The emergency classification was upgraded to an Alert at 1357 hours based on a report of a fire on the second floor of the turbine building in the area of the lubricating oil reservoir. The fire brigade was assembled and assistance, although not utilized, was requested from the local fire department. At 1400 hours it was determined that a fire in the lubricating oil area had not occurred. The previous communication to the control room operators had been misunderstood. The misunderstood communication was attributed to the difficulty of communicating with hand held radios while wearing self contained breathing equipment. At 1405 hours a small fire was identified in the generator brush rig area. This was extinguished with portable fire extinguishers.

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

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Fermi 2	05000 341	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 7
		93	- 014 -	01	

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A review of the event determined that the initial fire alarms were caused by a rapid hydrogen burn around the generator. The source of hydrogen was that used to cool the internals of the generator. The automatic fire suppression systems operated as designed.

Significant damage was sustained by the turbine/generator and the auxiliary systems. The exciter rotor [TL] had become disconnected from the turbine/generator shaft. A hole measuring approximately 18" x 30" was found in the northwest corner of the number 3 low pressure turbine hood. General Service Water [KG] and Turbine Building Closed Cooling Water [KB] Systems, which cool hydrogen [LJ] in the main generator and air within the exciter, respectively, were breached. Approximately 550,000 gallons of water from these two systems and the fire suppression system flooded the radwaste building [NE] and turbine building [NM] basement areas disabling the radwaste systems.

The turbine lubricating oil system [TD] also suffered significant damage. An estimated 17,000 gallons of turbine lubricating oil was spilled onto the turbine building floor areas and mixed with water in these areas.

The main condenser also sustained damage. An unknown number of condenser tubes were severed resulting in approximately 250,000 gallons of circulating water flowing into the condenser hotwell. This water was subsequently discharged through the condensate polishing demineralizers, compromising the effectiveness of the demineralizers. The water was discharged to the condensate storage tank [KA] as the hotwell level control system functioned to compensate for increasing hotwell water level. Reactor water quality deteriorated as the RCIC and SBFW systems utilized water from the condensate storage tank to maintain reactor water level.

All safety systems [JE] and isolations performed as designed. All safety systems were available throughout the event. Standby gas treatment [WF] was manually started in response to the loss of the reactor building HVAC [VA] system.

At 1722 hours the Emergency Director downgraded the emergency status to an Unusual Event based on stable plant conditions. The Unusual Event was terminated at 2052 hours based on the plant being in a stable condition.

On December 26, 1993, while preparing to place the reactor into cold shutdown, reactor recirculation discharge [AD] valve B3105-F031B failed to close. Had the reactor coolant level dropped to level 2 during the December 25, 1993 event, the low pressure coolant injection [(LPCI)(BO)] full flow may not have been available. LER 93-015 was submitted to address this valve failure.

LICENSEE EVENT REPORT (LER)
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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Fermi 2	05000 341	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 7
		93	- 014 -	01	

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

The plant was placed in cold shutdown at 2251 hours on December 26, 1993.

Cause of Event

The reactor scram was caused by the closure of the turbine control valves when the main turbine generator (MTG) tripped off line. The turbine trip was caused by the activation of the mechanical overspeed trip device. Activation of the mechanical overspeed trip device was due to severe vibration and not from an actual overspeed condition. The high vibration of the main turbine was the result of the failure of the number 9 blade on the 8th stage, turbine end of low pressure section number 3. The root cause of the blade failure has not yet been determined.

Analysis of Event:

An automatic reactor shutdown was initiated by the closure of the main turbine control valves. A turbine trip was initiated by the activation of the mechanical overspeed trip mechanism. Analysis of the turbine vibration data determined that this trip was initiated due to high vibration on the main turbine unit and was not due to an actual overspeed condition.

Reactor and safety system responses following the automatic shutdown, including the low level 3 actuation were normal. The turbine failure did not result in any abnormal release of radioactive material.

A comparison of the event against the UFSAR turbine missile analysis was made by Engineering and it was determined that this event was bounded by the UFSAR analysis.

The dynamic response of the reactor/auxiliary building to the MTG failure induced excitation was measured by earthquake recording devices located in the reactor/auxiliary building. The data from these devices show that the reactor/auxiliary building was not significantly excited or displaced by the MTG failure event.

There are three triaxial passive peak shock recorders installed in the following reactor/auxiliary building locations; High Pressure Coolant Injection (HPCI) room floor (El. 540'-0"), relay room floor (El. 613'-6"), and refueling floor (El. 684'-6"). These devices are capable of recording accelerations in the frequency range of 2-25 Hz and fully characterize the structural dynamic environment in the reactor/auxiliary building. Data from

NRC FORM 366A (5-92)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95	
LICENSEE EVENT REPORT (LER) TEXT CONTINUATION				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 (MNRB 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)		DOCKET NUMBER (2)		LER NUMBER (6)	
Fermi 2		05000 341		YEAR 93	SEQUENTIAL NUMBER 014
				REVISION NUMBER 01	PAGE (3) 5 OF 7

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

the relay room and refueling room recorders show no significant response resulted from the turbine event.

There are also two triaxial accelerometers located on the HPCI room floor and at the top of the reactor pedestal. The accelographs indicated three short duration acceleration excursions. The first and second were separated by approximately 2 seconds and the second and third were separated by approximately one minute. Engineering analysis determined these were not structurally significant. Further, there is no evidence that the four inch seismic isolation gap between the turbine and auxiliary building was infringed on during the turbine event.

An independent review of the data was conducted by an outside consultant. They determined that the instrumentation response was due to a shock impulse. A shock impulse imparts short duration, high amplitude, and low energy into a structure, whereas, an earthquake imparts long duration, broad frequencies, and high energy into a structure. Industry standards recognize shock impulses do not cause significant structural stresses. The report concluded that the shock wave length resulting from the turbine event was small compared to the building, and therefore produced local high accelerations, but the short duration, low energy, and small deformations associated with these high frequency accelerations did not compromise the structural integrity of the Reactor/Auxiliary building or the equipment therein.

Although planned walkdowns to examine the plant structures have not been fully completed, those structural items which have been inspected did not exhibit any evidence of loss of structural integrity.

Engineering has examined all accessible areas of the turbine pedestal. Based on their examination they have concluded that the turbine pedestal structural integrity remains intact.

Engineering is also examining the turbine support steel structure. Initial results found some cracks and tear of base metal in stiffeners in the low pressure section number 3 bearing box. These will be repaired.

The fire protection system performance during the event was reviewed by Engineering. Although there was some damage to the fire suppression system, the system responded as designed.

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FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Fermi 2		05000 341	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	6 OF 7
			93	- 014 -	01	

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An assessment of the effects of poor reactor water quality on fuel and vessel internals is in progress. Preliminary results indicate that there is no immediate or short term impact on vessel structural integrity. Long term effects on the vessel structural integrity are being assessed. The interim report also noted that there may be future problems associated with the Jet Pump Holddown Beams. Detroit Edison has decided to replace these during the current outage. In addition, preliminary review of the impact of poor water quality indicates that the zircaloy components of fuel, including fuel rod cladding, spacers and channels, should be insignificant. Inspection of some fuel assemblies, control rod drives, and control rod blades will be conducted to further assess for water chemistry concerns.

Corrective Actions:

An assessment of the structural integrity of the turbine pedestal was conducted. The structural integrity of the pedestal was verified to be intact. No structural repairs will be necessary.

Flood water located in the turbine building basement and radwaste building basement floors has been removed. Approximately 1.5 million gallons of water has been processed and discharged. This includes stored, high quality water which deteriorated in quality when it mixed with untreated water during the event.

Detroit Edison will complete those actions agreed to by the NRC and Detroit Edison management and specified in the Confirmatory Action Letter dated December 28, 1993. These actions will be completed prior to returning the unit to power operations.

Engineering has completed an inspection of the turbine building structure. They have concluded that the turbine building was not structurally compromised (i.e., it maintained its structural integrity) as a result of the turbine event. Some cosmetic repairs will be made. However, these repairs have no impact on structural integrity.

An investigation of the event was initiated by the Plant Manager. A turbine-generator assessment team (TGAT) was given the responsibility to determine the root cause of the main turbine generator trip and develop a plan for damage assessment, repair options, reassembly, startup, and monitoring turbine performance following implementation of the corrective action. Specifically the TGAT will:

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Fermi 2	05000 341	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	7 OF 7
		93	- 014 -	01	

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

Develop a sequence of events leading to the failure.

Determine the root cause of the turbine/generator failure.

Develop lessons learned

Publish a final report.

The assessment of the effects of the poor water quality on the fuel and reactor vessel internals is in progress. Preliminary results indicate that it would be prudent to replace the jet pump hold down beams. This will be done during the current outage. In addition, inspection of some fuel assemblies, control rod drives, and control rod blades will be done to further assess water chemistry concerns.

Walkdown of systems located in the turbine building to assess any damage and identify needed repairs is in progress.

A review of the response of the Emergency Response Organization and the Fire Brigade is being conducted and lessons learned are being developed.

Previous Similar Events:

None