Entergy

Entergy Operations, Inc.
P.O. Box 756
Port Gibson, Mississippi 39150
Tel: 601-437-2800

Christina Perino
Licensing Manager

GNRO-2010/00077

December 13, 2010

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

Subject: LER 2010-002-00 Control Room Air Conditioning Inoperability - Loss of Both Trains

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

Dear Sir or Madam:

Attached is Licensee Event Report (LER) 2010-002-00 which is a final report. This report is submitted in accordance with 10 CFR 73(a)(2)(v)(D).

This letter does not contain any commitments. Should you have any questions regarding the attached report, please call Rita Jackson at 601-437-2149 or Christina L. Perino at 601-437-6299.

Sincerely,

CLP/RRJ

Attachment: LER 2010-002-00

Cc: (See Next Page)

cc:

NRC Senior Resident Inspector
Grand Gulf Nuclear Station
Port Gibson, MS 39150

U.S. Nuclear Regulatory Commission
ATTN: Mr. Elmo E. Collins, Jr. (w/2)
Region Administrator, Region IV
612 East Lamar Blvd, Suite 400
Arlington, TX 76011-4125

U. S. Nuclear Regulatory Commission
ATTN: Mr. Alan Wang, NRR/DORL (w/2)
Mail Stop OWFN/8 G14
Washington, DC 20555-0001

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Control Room Air Conditioning Subsystem 'B' Tripped On Low Oil Pressure While the 'A' Subsystem was Inoperable for Maintenance Resulting in a Condition that Could Have Prevented the Fulfillment of the Mitigation Safety Function

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000 N/A
10	14	2010	2010	–002	– 00	12	13	2010	FACILITY NAME: N/A	DOCKET NUMBER: 05000 N/A

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Christina L. Perino, Licensing Manager	601-529-5719

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	VI	B002B	CVI, INC.	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On October 14, 2010 at 0422 hours, the Grand Gulf Nuclear Station (GGNS) Control Room Air Conditioning (CRAC) Subsystem B tripped on low oil pressure while CRAC subsystem A was out of service for maintenance. Control Room temperature increased and actions were taken to maintain Control Room temperatures below the Technical Specification (TS) limit of 90 degrees F. Causal analysis identified three possible failure modes for this event which included the intermittent failure of the low oil differential pressure switch due to a less robust design than the original; intermittent failure of one or more loading/unloading mechanisms due to inadequate work instructions; and one or more of the temperature control valves in an open condition or in a more than desired open condition. One contributing cause was identified for inadequate Foreign Material Exclusion controls during maintenance activities on CRAC B. These three probable causes and the contributing cause are addressed in GGNS's Corrective Action Program. Control Room temperature was maintained within limits until a CRAC subsystem was restored. This event is reportable under 10 CFR 50.73(a)(2)(v)(D).

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NARRATIVE

A. Reportable Occurrence

On October 14, 2010 at 0422 hours Central Daylight Time (CDT), Grand Gulf Nuclear Station (GGNS) was in Mode 1 operating at approximately 100 percent power, when the Control Room Air Conditioning (CRAC) [VI] system operating unit (subsystem B) tripped on low oil pressure while CRAC subsystem A was out of service for maintenance. The GGNS CRAC system provides a safety function that falls within the scope of 10 CFR 50.73(a)(2)(v)(D). The event that occurred (i.e., one subsystem inoperable and unavailable for maintenance while the other subsystem was inoperable and unavailable due to a trip) is reportable under 10 CFR 50.73(a)(2)(v)(D) as an event or condition that could have prevented the fulfillment of the safety function to mitigate the consequences of an accident. The CRAC system is designed to maintain a habitable environment and maintain temperature to ensure the operability of components in the control room. CRAC B was inoperable for approximately 319 hours. However, the two CRAC subsystems were inoperable (loss of safety function) for 64 hours and 24 minutes until CRAC A was declared operable.

B. Initial Conditions

The reactor was in OPERATIONAL MODE 1 with reactor power at approximately 100 percent. There were no additional inoperable structures, systems, or components that contributed to this event.

C. Description of Occurrence

On October 14, 2010 at 0422 hours, the GGNS CRAC subsystem B compressor tripped on low usable oil pressure while CRAC subsystem A was out of service for maintenance. This resulted in entry into Technical Specification (TS) Required Action 3.7.4.B. The Control Room temperature increased and compensatory measures were taken to provide alternate cooling (opening doorways with the Control Room Fresh Air Units operating) and to add temporary cooling to maintain Control Room temperatures below the TS limit of 90 degrees F.

During this time, two Control Room alarms were received apparently due to the elevated temperatures. A Rod Control and Information System Inoperable (RCIS INOP) alarm came in at 0937 hours and could not be reset. Control room temperature was elevated at approximately 87 degrees F at the time. RCIS was reset successfully at 1202 hours, after CRAC B was restored and Control Room temperature was lowered to 79 degrees F. In addition, Control Room alarm Component Cooling Water Division 1 Motor Operated Valves Trouble (CCW DIV 1 MOVs TROUBLE) was received at 0940 hours while the Control Room temperature was approximately 87 degrees F. There was no other apparent cause for the alarm. The alarm also cleared at 1233 hours, after CRAC B was restored and Control Room temperature was lowered to 76 degrees F. CRAC B was restored to running status at approximately 1130 hours on October 14, 2010 but was not declared operable.

After CRAC A was declared operable on October 16, 2010 at 2046 hours, CRAC B compressor was disassembled, inspections were performed, and maintenance activities began. Upon completion of the maintenance, the unit was tested. The system was run for 10 hours in which the unloaders were tested to ensure the system was loading and unloading as designed. Data was collected during this 10 hour run which determined that the compressor, condenser, pressure switch, associated control circuit, liquid line filter and evaporator were functioning correctly. Additionally the superheat on all six replaced temperature control valves, air side suction and exhaust temperatures and air side flow rates were validated to be within expected values.

NARRATIVE

Based on satisfactory testing following the completion of the immediate corrective actions, a recent 67 hours of continuous run, the replacement of the six thermal expansion valves, a maintenance retest run performed on October 30, 2010, and a 24-hour operability run with the Standby Fresh Air heaters performed October 31, 2010 to November 1, 2010, the CRAC B system was declared operable and returned to service.

D. Cause of Occurrence

The primary method used to determine the root cause for the equipment problems associated with this event was the Kepner-Tregoe (KT) Problem Analysis process. The KT Problem Analysis identified three possible failure mechanisms based on the as-found condition of the equipment and the maintenance performed as follows:

1) Intermittent failure of the low oil differential pressure switch which is in the trip circuitry of the compressor and trips the compressor on low differential pressure. The replacement differential pressure switch was a less robust design than the originally supplied switch.

   The replacement differential switch that was installed on the CRAC B train did not provide consistent trip actuation compared to the installed gauges. This was demonstrated with two out of the three replacement switches used.

2) Intermittent failure of one or more loading/unloading mechanisms due to inadequate work instructions of the compressor rebuild preventive maintenance tasks.

   During the last compressor rebuild prior to the October 14, 2010 trip, the loaders/unloaders were not disassembled and inspected. The preventive maintenance (PM) task instructions did not specifically address an inspection of the loader/unloaders. After the number six cylinder loader/unloader was replaced, normal usable oil pressure was achieved. The number six cylinder was replaced because wear marks were found on one of the internal surfaces indicating that this cylinder may have experienced oil leakage.

3) One or more of the temperature control valves were in an open condition or in a more than desired open condition. The established periodicity or method used to prevent or detect equipment degradation was not effective. The degree of superheat had not been routinely measured and recorded. Had this been done, a degrading trend may have been detected and corrected prior to a compressor trip.

   The design purpose of the thermal expansion (temperature control) valve is to maintain a constant degree of superheat across the evaporator. It senses the exhaust temperature and adjust Freon flow by opening and closing an integrated control valve. If one or more of these valves was to fail in an open condition or more than desired open condition then more Freon would be allowed to flow through the evaporator coils, losing superheat and allowing very cold Freon to the compressor. The dissolved Freon in the oil boils out and carries the oil into the condenser.

A Contributing Cause of failure to exclude foreign material during maintenance activities on CRAC B was identified. Actions taken to preclude the entrance of any undesirable material were inadequate.

A single root cause could not definitively be determined; however, GGNS made the decision to address all three of the possible root causes as well as the contributing cause.

E. Corrective Actions

Immediate Actions

Immediate actions following this event were to recover CRAC A, place it in service and then disassemble CRAC B compressor, perform inspections, retrieve oil samples and perform maintenance. Additionally, the CRAC B compressor was rebuilt, including replacing all six thermal expansion valves, the differential oil pressure switch, the filter dryer and the number six loader/unloader.

Short and Long Term Actions

The corrective actions for the three probable root causes are listed below.

1) Ensure that only original differential pressure switches (or a suitable equivalent) can be used and exclude the replacement switch model that was utilized to replace the original switch. Update all applicable parts lists. This switch CAT ID 99193008 Model FD113ZUK is manufactured by Emerson/Alco.

2) Revise compressor PM tasks for both A and B compressors to include lessons learned from Trane benchmarking. This will include detailed instructions for the loader/unloader disassembly, inspection and re-assembly. Revise tasks for compressor A and B rebuilds.

3) Revise compressor PM tasks for both A and B compressors to record degree of superheat for each thermal expansion valve. Revise leak check PM tasks.

The corrective actions for the contributing cause are:

- Provide additional guidance in the compressor PM for both compressors.
- Revise performance monitoring plan for CRAC system to ensure monitoring criteria are complete and robust.
- Revise the control building operator rounds to provide tighter operating limits for CRAC compressor lube oil suction and discharge pressures differential pressure.

These corrective actions and others are being tracked in GGNS's Corrective Action Program under CR-GGN-2010-7315.

F. Safety Assessment

According to the GGNS Technical Specification Bases, the design basis of the CRAC System is to maintain the control room temperature for a 30 day continuous occupancy and ensure the OPERABILITY of components in the control room. The ability of the CRAC System to maintain the control room temperature during Modes 1, 2, and 3 is implicitly assumed in the analyses of the design basis accidents (e.g., loss of coolant accident, main steam line break). The TS Bases also states that the Control Room AC System satisfies Criterion 3 of the NRC Policy Statement. This means that it is considered to be a part of the primary success path which functions to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

The GGNS UFSAR states that the control room HVAC system design ensures that the operability of the safety-related control and instrumentation equipment will not be impaired due to environmental conditions and will continue to function in a satisfactory environment. Therefore, no special environmental design requirements have been incorporated in the qualification of equipment located in the control room.

Since the Control Room temperature was maintained within limits until a CRAC subsystem was restored, there was no impact to the equipment located in the control room with exception of the following two systems.

Two Control Room alarms were received apparently due to the elevated temperatures;

- A RCIS INOP alarm came in at 0937 and was reset several times, but would not stay reset. Control room temperature was elevated at approximately 87 degrees F at the time. RCIS was reset successfully at 1202 hours, after CRAC B was restored and Control Room temperature was lowered to 79 degrees F. During the RC&IS INOP period the rod gang drive cabinet analyzer stopped, this does not compromise the safety function of the system. The rod positions are still available at the rod action control cabinets.

- The Control Room alarm CCW DIV 1 MOVs TROUBLE (Component Cooling Water Division 1 Motor Operator Valve Trouble Alarm) was received at 0940 hours while the Control Room temperature was at approximately 87 degrees F. There was no other apparent cause for the alarm. The alarm cleared at 1233 hours, after CRAC B was restored and Control Room temperature was lowered to 76F (CR-GGN-2010-07299). The Alarm Response Instruction (ARI) immediate actions were performed for this alarm. No failure status lights were illuminated. No CCW DIV 1 MOVs had power loss, no trip units were tripped or gross failed. The cause of the alarm could not be determined; it was most likely due to an intermittent annunciator circuit. No CCW components were affected.

The CRAC system also maintains control room habitability. This function was not affected by this event.

The control building is outside of the radiological controlled area therefore there were no radiological concerns for this event, nor were there any industrial safety concerns associated with the event.

G. Additional Information

Previous Occurrences - There has not been any occurrence of an event or condition in the past five years at Grand Gulf Nuclear Station involving these same conditions. The Root Cause Evaluation addressed the extent of condition as well as the extent of the cause of this event. There are two identical trains of CRAC, A and B. No other air conditioning systems in the plant use the CVI Inc. model unit. CRAC A unit was reviewed for extent of condition relating to low usable oil pressure trips on the B unit. There is no immediate concern with CRAC A. All Corrective Actions for CRAC B are being applied to CRAC A.

NRC FORM 366A
(9-2007)

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

U.S. NUCLEAR REGULATORY COMMISSION

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NARRATIVE

An Operating Experience search was performed using multiple searches. No recordable differential pressure switch multiple failure OE cases with the original switch or replacement switch were noted and no Significant Operating Experience Report (SOER) / Industry Event Report (IER) cases were found matching any of the identified root causes.