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A Duke Energy Company

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March 15, 2004

U. S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Duke Energy Corporation
Catawba Nuclear Station Unit 1
Docket Nos. 50-413
Licensee Event Report 413/2004-001 Revision 0

Attached please find Licensee Event Report 413/2004-001 Revision 0, entitled "Gas Accumulation in Centrifugal Charging Pump Suction Piping". A supplemental report is scheduled to be submitted June 15, 2004 to provide additional information for the root cause investigation and safety analysis.

This report does not contain any NRC commitments.

Questions regarding this Licensee Event Report should be directed to G. K. Strickland at 803-831-3585.

Sincerely,

R. Michael Glover /for

D. M. Jamil

Attachment

IE22

xc:

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NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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)

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4. TITLE

Gas Accumulation in Centrifugal Charging Pump Suction Piping

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	14	2004	2004	- 001 -	00	03	15	2004	FACILITY NAME	DOCKET NUMBER

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

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
G. K. Strickland, Regulatory Compliance	803-831-3585

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
B1a	CB	1NV0235	D243	Y					

14. SUPPLEMENTAL REPORT EXPECTED			15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
X	YES (If yes, complete EXPECTED SUBMISSION DATE).	NO		06	15	2004

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

On January 14, 2004 gas was discovered at the suction piping of the centrifugal charging pumps. Due to the lack of a firm bases to support operability, Engineering conservatively concluded that the gas volume was greater than the acceptance criteria necessary for pump operability. This condition resulted in the unit being in an unanalyzed condition. The system was vented and the pumps restored to operable condition.

One of the causes of the gas accumulation was reverse leakage from relief valve 1NV235 on the emergency boration line. The relief valve has been replaced. Additional troubleshooting is in progress to identify additional sources of gas accumulation. The troubleshooting results will be provided with the June 15, 2004 submittal. The submittal will also include the engineering analysis to determine whether the centrifugal charging pumps were operable.

During the event investigation, the charging pump suction piping was frequently monitored and vented to maintain the system filled with water. No pump degradation was observed. No plant transient occurred that relied upon the safety function of the charging pumps.

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

BACKGROUND

This event is being reported under the following criteria:

10CFR50.73(a)(2)(i)(B), any operation or condition which was prohibited by the plant's Technical Specifications,

10CFR50.73(a)(2)(ii)(A) and (B), any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, and the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety; and

10CFR50.73(a)(2)(v)(A) and (D), any event or condition that could have prevented the fulfillment of the safety function of structures or systems.

Catawba Nuclear Station Unit 1 is a Westinghouse four-loop pressurized water reactor [EIIS: RCT]. The Chemical Volume and Control System [EIIS: CB]serves as part of the Emergency Core Cooling System (ECCS) to provide high pressure injection and recirculation of borated water to the Reactor Coolant System cold legs following a design basis accident. The ECCS components are designed such that a minimum of one centrifugal charging pump (high head), one safety injection pump (intermediate head) [EIIS: BQ], one residual heat removal pump [EIIS: BP] and heat exchanger (low head), and three cold leg accumulators along with their associated valves and piping will assure adequate core cooling in the event of a design basis accident.

Technical Specification (TS) 3.5.2 requires two trains of ECCS pumps to be operable during Modes 1 - 3. With one train inoperable, the train must be restored to operable status within 72 hours. With two trains inoperable, TS 3.0.3 requires action to be taken within 1 hour to place the unit in Mode 3 within 7 hours.

At the time of this event, Unit 1 was operating in Mode 1 at 100 percent power. During the event investigation, several safety systems were removed from service for routine surveillance testing and maintenance activities. No structures, systems, or components were

removed from service that had any effect on the event or conflicted with Technical Specifications.

EVENT DESCRIPTION (Times are approximate)

Date	Time	Event Description
12/08/03	1557	ECCS venting procedure completed in preparation for unit startup. Unit 1 operating in Mode 6. No significant amount of gas identified during the venting procedure.
12/16/03	0145	Unit 1 entered Mode 3.
01/07/04	1622	ECCS venting procedure completed for the monthly surveillance. Approximately 1 minute of gas vented from the vent valve (1NV858) on the ECCS suction line from the refueling water storage tank. The vent valve 1NV858 was cracked open. Because the valve was cracked open, there is no accurate means of measuring the amount of gas that was vented. Data from ultrasonic testing or change in the volume control tank level was not available. Additional vent valves were opened and no additional gas identified. Engineering conservatively approximated a maximum of 1.6 cubic feet of gas vented from 1NV858 based on the vent time and assuming the valve was fully open. It is possible that less gas may have been vented because the venting procedure is a qualitative assessment to determine if any gas is present in the system and not a quantitative measure of the amount of gas present. Initial belief that gas entered the piping during an outage alignment following the vent performed on 12/8/03. ECCS venting frequency increased from monthly to weekly. Event entered into the corrective action

program for further evaluation.

01/14/04 1200 to 1500 ECCS venting procedure completed and approximately 5 minutes of gas vented from 1NV858 and approximately 2 minutes and 10 seconds of gas vented from 1NV860 (charging pump suction piping from residual heat removal pump A). Engineering approximated 76 gallons (10.2 cubic feet) vented from 1NV858 and approximately 60 gallons (8.0 cubic feet) vented from the 1NV860.

A Failure Investigation Team assembled to identify the source of gas accumulation. A systematic investigation of all possible sources of gas intrusion initiated.

01/15/04 1850 In the absence of engineering analysis to confirm operability, Engineering conservatively recommended the centrifugal charging pumps suction in the containment sump recirculation flow path from A-train were inoperable based on the rate and amount of gas accumulation at 1NV860 vented 1/15/04 1700 hours.

01/15/04 1857 Periodic venting identified gas accumulation limited to the charging pump suction piping from residual heat removal pump A (1NV860) - "piggyback flowpath". Valve 1ND-28A de-energized to prevent any gas at valve 1NV860 from being aligned to the charging pumps. The 72-hour action statement for TS 3.5.2 entered for one train of ECCS inoperable.

01/15/04 2339 8-hour phone notification to NRC completed based on evaluation at 1850 hours.

01/15/04 to 1/18/04 Frequent ultrasonic testing (UT) of suction piping was implemented to closely monitor gas accumulation. Gas periodically vented to maintain the piping filled.

01/18/04 1725 Potential gas entry locations and generation mechanisms evaluated. Based on the decreasing gas volume, the gas origin believed to be related to

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makeup water pump 1B maintenance. Investigation of gas intrusion source continued.

Power restored to valve 1ND-28A and TS 3.5.2 exited after completion of 24 hours without significant voids in suction piping. Ultrasonic testing was continued in order to closely monitor gas voids in the charging pump suction piping.

01/19/04 0350 Gas void discovered at 1NV860 using ultrasonic testing.

01/19/04 0430 TS 3.0.3 entered for both trains of ECCS inoperable.

01/19/04 0506 TS 3.0.3 exited after gas vented at 1NV860.

01/19/04 0715 Valve 1ND-28A de-energized. The 72-hour action statement for TS 3.5.2 entered for one train of ECCS inoperable.

01/19/04 1123 8-hour phone notification to NRC completed.

01/19/04 Investigation of gas accumulation continued.
to
01/22/04 Frequent ultrasonic testing (UT) of suction piping continued to closely monitor gas accumulation. Gas periodically vented to maintain the piping filled.

Source of gas accumulation not identified and system determined operable with compensatory measure established to maintain the piping filled and vented. One of the actions included isolation of the primary sample purge line connected to the volume control tank relief valve header.

01/22/04 0707 Power restored to valve 1ND-28A and TS 3.5.2 exited with both trains of ECCS operable.

No significant amount of gas identified after TS 3.5.2 exited on 1/22/04.

01/22/04 to 02/7/04	Deliberate, systematic troubleshooting plan developed and implemented to confirm the source of the gas.
02/7/04	One source of gas identified as reverse leakage from the relief valve 1NV235 on the emergency boration line.
02/24/04	Relief valve 1NV235 replaced.
03/13/04	Troubleshooting activities involving 1NV235 indicated gas accumulation was still present when the primary sample purge line was aligned to the volume control tank relief valve header. The primary sample purge line was isolated before and after the troubleshooting activities to prevent gas accumulation. Troubleshooting activities continue.

CAUSAL FACTORS

The root cause investigation is still in progress. The June 15, 2004 supplemental report will provide an update of the investigation.

One cause of the gas accumulation was reverse leakage of gas in the volume control tank relief header through valve 1NV235. The relief valve 1NV235 is connected to the emergency boration line to the charging pump suction. A second cause of the event is the design of the system (piping configuration) that leads to vulnerability for gas intrusion.

Maintenance was performed on relief valve 1NV235 during the past outage and the post-maintenance functional testing was satisfactory. The relief valve is suspected to have lifted during the emergency core cooling system check valve testing when the charging pump suction was aligned to the residual heat removal pump discharge. Following the check valve test, the relief valve may not

have fully closed. Check valve 1NV234 would have had to leak in the backward direction in order for relief valve 1NV235 to lift during emergency core cooling system check valve testing.

The review of the valve maintenance activities, check valve testing procedures, or plant equipment monitoring has not identified any performance deficiencies.

CORRECTIVE ACTIONS

Immediate:

1. Venting frequency increased upon initial discovery of gas accumulation.

2. Ultrasonic testing conducted at the charging pump suction piping to monitor for gas accumulation. Gas periodically vented to maintain system filled.

3. Failure investigation team assembled to determine the cause of gas accumulation.

4. Compensatory measures established to maintain the system operable. Compensatory measures included monitoring of the suction piping and temporary isolation of the primary sample purge line.

Subsequent:

1. One source of gas accumulation identified from relief valve 1NV235. The relief valve was replaced.

2. Unit 2 evaluated and determined to not have the same concern as the Unit 1 gas event due to the relief valve header pipe configuration.

Planned:

1. Relocate Unit 1 primary sample purge line connection to the relief valve header.

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2. Revise Unit 1 emergency core cooling check valve test procedure, as needed, based on the root cause investigation.

3. Troubleshooting of the gas accumulation continues. The source of gas accumulation is currently isolated by closing the primary sample purge line valves.

The planned corrective actions are being addressed within the Catawba Corrective Action Program. There are no NRC commitments contained in this LER.

SAFETY ANALYSIS

Throughout the gas accumulation, the charging pumps did not exhibit any degradation in pump operating parameters. The pumps flow, pressure, temperature, vibration, and noise were normal with no evidence of gas binding or gas intrusion during normal charging operation.

Ultrasonic testing of the suction piping was instituted early to monitor gas accumulation and maintain the system vented, thereby reducing the time that the pumps were inoperable. Testing frequency was as often as every two hours until an estimate of the gas accumulation rate was established. Testing frequency was adjusted based on plant conditions and venting results.

Prior to the event, surveillance testing was maintained within the Technical Specification requirements. The isolation of valve 1ND-28A was within the Technical Specification Action time limits. The leakage rates exhibited by the sample valves were within the containment leak rate acceptance criteria.

The charging suction piping configuration was reviewed for pump operability. The B-train charging pump suction is connected to the bottom of the common suction piping and ninety degrees from the flow path thereby decreasing the likelihood of gas transport to the pump. The velocities in the B-train suction line at design flow are insufficient to transport gas in the eight-inch horizontal suction line to the 1B charging pump suction. Therefore, for the gas discovered on 1/7/04 and 1/19/04, the B-train pump was concluded to be operable.

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The A-train charging pump suction has several of the same attributes as the B-train pump with the exception that the suction is in the flow stream of the common header. The A-train suction has several elbows and is approximately five feet below the common header. Absent a detailed flow calculation, the A-train pump was conservatively determined to be inoperable on 1/7/04, 1/14/04, and 1/19/04.

The gas accumulated in the suction piping was observed to be stationary during plant operations and for normal system flow rates of approximately 100 gpm. A suction flow rate of 200 gpm or higher was estimated to be necessary to sweep the gas into the pump. However, absent a detailed flow calculation, both charging pumps were conservatively considered inoperable on 1/14/04.

An independent, detailed flow evaluation is being conducted to determine the amount of gas required to render one and two pumps inoperable. The results of the flow analysis will be used to quantitatively determine the safety significance of the event. The flow analysis may also change the event reporting criteria. A revision to the event report is anticipated by June 15, 2004.

ADDITIONAL INFORMATION

Within the last three years, no other LERs occurred at Catawba involving gas accumulation in the charging pump suction. Therefore, this event was determined to be non-recurring in nature.

A review of industry operating experience indicates that gas intrusion is an industry concern and events have been identified at other sites. However, the Catawba event is a new, previously unidentified failure mechanism for gas introduction into the charging pump suction. Therefore, this event could not have been prevented from the review of operating experience.

Energy Industry Identification System (EIIS) codes are identified in the text as [EIIS: XX]. This event is considered reportable to the Equipment Performance and Information Exchange (EPIX) program.

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This event met the reporting criteria of 10 CFR 50.73(a)(2)(v) and therefore will be recorded under the NRC Performance Indicators for Unit 1 as a Safety System Functional Failure.

There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.