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SUBJECT: LER 98-001-02:on 980104,containment air recirculation sys flow testing resulted condition outside design.Caused by sys unbalanced & mispositioned valve.Actuator to valves orientation was corrected.W/980508 ltr.

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May 8, 1998

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Docket No. 50-315

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In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Report System, the following report is being submitted:

98-001-02

Sincerely,

John R. Sampson

J. R. Sampson
Site Vice President

/mbd

Attachment

c: A. B. Beach, Region III
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IE22

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 (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.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	
Donald C. Cook Nuclear Plant - Unit 1	50-315	Page 1 of 5

TITLE (4)
Containment Air Recirculation System Flow Testing Results Indicate Condition Outside the Design Basis

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
01	04	98	98	– 001 –	02	05	08	98	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5
POWER LEVEL (10)	00

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

	20.2201(b)		20.2203(a)(3)(i)		50.73(a)(2)(iii)		73.71(b)
	20.2203(a)(1)		20.2203(a)(3)(ii)		50.73(a)(2)(iv)		73.71©
	20.2203(a)(2)(i)		20.2203(a)(4)		50.73(a)(2)(v)		OTHER
	20.2203(a)(2)(ii)		50.36(c)(1)		50.73(a)(2)(vii)	(Specify in Abstract below and in Text, NRC Form 366A)	
	20.2203(a)(2)(iii)		50.36(c)(2)		50.73(a)(2)(viii)(A)		
	20.2203(a)(2)(iv)		50.73(a)(2)(i)		50.73(a)(2)(viii)(B)		
	20.2203(a)(2)(v)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Mr. Paul Schoepf - Safety Engineering Mechanical Systems Manager	616/465-5901, x2408

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)

During the month of January, 1998, airflow testing of the Unit 1 and Unit 2 containment air recirculation/hydrogen skimmer (CEQ) system was performed. The test demonstrated that as-found flows in certain steam generator and pressurizer compartments, fan-accumulator rooms, and instrument rooms were less than the flows stated in UFSAR Section 5.5.3. An ENS notification was made on January 5, 1998 in accordance with 10CFR50.72(b)(2)(I) and updated on January 19, 1998. An interim LER for this condition was submitted on February 3, 1998, in accordance with 10CFR50.73(a)(2)(ii) as a condition outside the design basis, as is this updated LER.

In general the low flow results are attributed to the system not being balanced and to system design, as well as the conditions under which the system was tested. In addition, an incorrectly installed valve actuator affected the Unit 1 CEQ system performance. A modification was installed on both unit's CEQ system to increase the air flow from the pressurizer enclosure. The procedure used to set the actuator and valve orientation for the affected Unit 1 valve was enhanced. Through post modification testing and analysis, both unit's CEQ systems meet system performance acceptance criteria as defined in Chapter 5 of the FSAR.

The pressurizer and steam generator compartments have been analyzed for hydrogen generation using the Unit 1 Cycle 16 and Unit 2 Cycle 12 values. The results of the analysis shows that the hydrogen stays below the 4 percent volume limit. Further analyses will be performed to determine that the Unit 1 Cycle 16 and Unit 2 Cycle 12 values are bounding for all cycles for which the low flow condition was present. Based on initial engineering review, hydrogen concentration in the lower containment annulus will be below the acceptance criteria. Additional calcuations are expected to be completed by July 15, 1998. Should the results indicate hydrogen values beyond four percent volume in any of the subcompartments, an updated LER will be submitted.

Conditions Prior to Occurrence
Unit 1 was in Mode 5, Cold Shutdown
Unit 2 was in Mode 6, Cold Shutdown

Description of the Event
During testing of the containment air recirculation/hydrogen skimmer (CEQ) system, certain flows in the steam generator and pressurizer compartments, fan-accumulator rooms, and instrument room were found to be less than the flows stated in UFSAR Section 5.5.3.

The hydrogen skimmer system is designed to control the hydrogen concentration in the compartments below 4 volume percent. This is accomplished by purging the compartments using a portion of the atmosphere in the lower containment. This flow mixes the atmosphere from the lower containment with the atmosphere in the compartment, diluting any hydrogen that is generated in the compartment. The lower flows could reduce the effectiveness of this mixing effect.

Cause of the Event
The low flow conditions are attributed to the system being unbalanced, as well as, the conditions in which the system was tested. The test condition is described as system recirculation flow through equipment hatches versus the ice condenser. In this configuration, the hydrogen skimmer flow from the steam generator, pressurizer doghouses, and fan rooms, are reduced. After balancing the system, it was determined analytically that the flow from the pressurizer doghouse would marginally meet or fail to meet its design criteria as defined in Chapter 5 of the FSAR. This was considered a design problem related to the pipe size serving the pressurizer doghouse.

With respect to 1-HV-CEQ-1, the root cause of the event was a mispositioned valve actuator for valve 1-VMO-101 (Unit 1 fan 1-HV-CEQ-1) in the hydrogen skimmer system. Valve 1-VMO-101 is a motor operated butterfly valve which opens when the recirculation fan starts. The installed actuator allowed the valve to open 45 degrees from the centerline in the fully open and the fully closed positions.

When the valve actuator is placed on a valve, it is aligned with a valve shaft keyway which is parallel to the valve disc. Valve 1-VMO-101 has an extension, and the extension has a keyway which is rotated 45 degrees from the valve shaft keyway's position. The actuator was installed in relation to this keyway rather than the valve shaft keyway. This occurred because the procedure which specified that the actuator was to be installed did not contain specific instruction to use the valve shaft keyway as a reference.

Additionally, the valve testing program and the post maintenance testing (PMT) requirements did not detect this condition. Because of the actuator's stop settings, the increased torque observed during valve operation was attributed to valve seating when it was due to contact with the stops. The PMT test only checked that the actuator was properly functioning.

Analysis of the Event

Pressurizer Compartment Analysis

A hydrogen compartment analysis has been recently completed. The major difference of this analysis from the previous hydrogen compartment analysis is an increase in core-wide metal-water reaction. This analysis was performed with the Unit 1 Cycle 16 and Unit 2 Cycle 12 specific core-wide metal-water reaction values. The analysis was also performed with a nominal pressurizer skimmer flow of 301 cfm; this is the 2-HV-CEQ-2 as-left pressurizer flow minus the 30 cfm measurement uncertainty.

The maximum hydrogen concentration in the pressurizer enclosure was calculated by using a 2-inch Design Basis Accident (DBA) hydrogen release to the pressurizer enclosure. This analysis assumes 100 percent of the core radiolysis, 10 percent of the sump radiolysis, 10 percent of the metal-water reaction hydrogen, and 10 percent of a 2-inch break steam flow is directed into the pressurizer enclosure. A 2-inch break was selected to delay operation of the CEQ/skimmer fans until the ice bed is melted out. Assuming 10 percent of the steam flow is directed to the pressurizer enclosure is conservative since 100 percent of the core radiolysis is directed to the pressurizer enclosure. Analysis shows the hydrogen concentration for the first 22 hours is less than the flammable limit of 4 volume-percent with a nominal pressurizer flow of 301 cfm.

The pressurizer enclosure hydrogen concentration continues to show a long term increase because the compartment analysis does not include removal of hydrogen by the hydrogen recombiners. The lumped-volume containment hydrogen analysis is used to demonstrate that the hydrogen recombiners maintain the hydrogen concentration below the flammable limit. A lumped-volume analysis with 5 percent metal-water (a value greater than the Unit 1 Cycle 16 and Unit 2 Cycle 12 values) demonstrated that the hydrogen recombiners maintain a hydrogen concentration below 4 volume-percent.

As discussed above, this analysis (and the steam generator analysis discussed next) was performed with the Unit 1 Cycle 16 and Unit 2 Cycle 12 specific core-wide metal-water reaction values. It has not yet been determined whether these cycle specific values bound all cycles for which the identified condition was present. This work will be done in conjunction with the development of the instrument room and fan-accumulator room models discussed below.

Steam Generator Compartment Analysis

Like the pressurizer enclosure, the maximum hydrogen concentration in the steam generator enclosure was obtained by using a 2-inch design basis accident hydrogen release to the steam generator enclosure. An analysis of the steam generator enclosure was performed with a hydrogen skimmer flow of 500 cfm per pair of steam generators. This flow rate (500 cfm) is the design value for the steam generator enclosures. The steam generator enclosure analysis was repeated with a nominal hydrogen skimmer flow of 207 cfm per steam generator pair. This analysis input value is the 1-HV-CEQ-1 as-found skimmer flow of 237 cfm for steam generators 2 & 3 minus the measurement uncertainty of 30 cfm. Even with the reduced flow, the steam generator enclosure hydrogen concentration remains below 3 volume-percent and the flammable limit of 4 volume-percent. As with the pressurizer enclosure analysis, the lumped-volume containment hydrogen analysis is used to demonstrate that the hydrogen recombiners maintain the hydrogen concentration below the flammable limit throughout containment.

Analysis of the Event (cont'd)

Fan-Accumulator and Instrument Rooms Analysis

Though the current hydrogen compartment analysis is sufficiently detailed to calculate the hydrogen concentration in the pressurizer and steam generator enclosures, it does not model the separate rooms in the annulus. Based on initial engineering review, the subcompartment hydrogen concentrations will be below the acceptance criteria.

The renodalization of the containment computer model and review of core-wide metal-water reaction amounts for previous cycles is ongoing. Should calculation results, which are expected by July 15, 1998, indicate hydrogen values beyond four percent volume in any of the subcompartments, an updated LER will be submitted.

Ice Condenser Bypass

The mispositioned valve 1-VMO-101 would not only affect the hydrogen skimmer system flows following a LOCA event, but would also affect the post-LOCA ice condenser performance by creating a bypass flow path. The valve's disk position of 45 degrees, rather than fully closed, during the initial 9 plus or minus 1 minutes of the large break LOCA event provides a flow path for blowdown steam directly to upper containment, bypassing the ice condenser. Greater bypass flow increases the peak pressure due to compression of noncondensible gases in upper containment. (This is not the maximum post-LOCA peak pressure; the maximum post-LOCA peak pressure occurs after ice bed melt out due to containment heating and decreases with increasing bypass flow.) The compression-induced peak pressure was calculated with a bypass area of 5 square feet. The 5 square feet consists of 2.2 square feet of known bypass flow area plus a margin of 2.8 square feet. In addition, a sensitivity analysis has shown that up to 35 square feet of bypass area is acceptable. The mispositioned valve (1-VMO-101) has a nominal inside diameter of 14 inches. Conservatively neglecting the valve disc, the flow area through the valve is 1.07 square feet. Since this flow area is less than the 2.8 square feet bypass area margin, the containment analysis is not affected by the misposition of valve 1-VMO-101.

Corrective Action

The actuator to valve orientation was corrected, and the actuator stops were changed to ensure that valve testing would detect valve seating. Flow testing of the system was conducted to ensure proper orientation of the valve actuator.

Reviews of other valves where this condition might occur were made, and three additional valves were identified. These valves were examined, and the actuators were found to be properly oriented.

To improve the flow conditions from the pressurizer doghouse, a Plant Modification (12-DCP-876) was performed. The modification replaced a section of 6 inch diameter pipe serving the pressurizer doghouse with an 8 inch diameter pipe. The new pipe section was placed between the 6 inch pressurizer doghouse balancing valve and the 12 inch diameter main pipe. Each CEQ system performance was demonstrated through post modification testing, and analysis, to meet all acceptance criteria as defined in Chapter 5 of the FSAR.

Corrective Action (cont'd)

CEQ Post-Mod As-Left Flows at Accident Condition

Area	1-HV-CEQ-1	1-HV-CEQ-2	2-HV-CEQ-1	2-HV-CEQ-2
SG #1 and 2	541 CFM	520 CFM	664 CFM	520 CFM
Pressurizer	530 CFM	610 CFM	638 CFM	550 CFM
SG #1 and 4	643 CFM	602 CFM	539 CFM	554 CFM
East Fan Rm	127 CFM	141 CFM	135 CFM	136 CFM
Instrument Rm	138 CFM	153 CFM	117 CFM	128 CFM
West Fan Rm	113 CFM	125 CFM	119 CFM	149 CFM
Cont. Dome	1193 CFM	1211 CFM	1335 CFM	1383 CFM
Recirc	41, 657 CFM	42,389 CFM	41,962 CFM	44,163 CFM

Preventive Action

The maintenance procedure was enhanced to ensure that the valve shaft keyway is used to set the actuator and valve orientation and not the extension shaft keyway.

The valve testing program is being revised to allow valve disc seating to be identified.

Previous Similar Events

LER 316/97-009-00