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December 18, 1989

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

Subject: Catawba Nuclear Station
Docket No. 50-414
LER 414/89-20

Gentlemen:

Attached is Licensee Event Report 414/89-20, concerning Technical Specification 3.0.3 entry and five month Auxiliary Building ventilation system inoperability due to a clogged air flow monitor causing reduced flow.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony B. Owen
Station Manager

keb\LER-NRC.TBO

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IE22
1/1

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

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TITLE (4) Technical Specification 3.0.3 Entry and Five Month Auxiliary Building Ventilation System Inoperability Due to a Clogged Air Flow Monitor Causing Reduced Flow

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 NAMES	DOCKET NUMBER(S)
									N/A	0 5 0 0 0
1 1	1 1	8 9	8 9	0 2 0	0 0	1 2	1 8	8 9		0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 0 9 8

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

20.402(b)	20.405(c)	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 (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
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	TELEPHONE NUMBER (AREA CODE)
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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)

YES (If yes, complete EXPECTED SUBMISSION DATE) — NO: X

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

On November 11, 1989, low filtered exhaust flow was discovered by Control Room Operators during observation of Control Room indications. Unit 2 was in Mode 1, Power Operation, at 98% power at the time of discovery. The Unit 2 Auxiliary Building Ventilation System was declared inoperable and Unit 2 entered Technical Specification 3.0.3 at 1740 hours. Subsequent investigation found that an actual low flow condition existed. A work request was issued immediately to inspect and clean Air Flow Monitor Device 2ABFX-AFMD-1. By 1812 hours, 2ABFX-AFMD-1 had been found clogged with lint from the Radiation Protection (RP) clothes dryers and cleaned. The Unit 2 Filtered Exhaust fans were then returned to service. At 1825 hours, Technical Specification 3.0.3 was exited after all flows and indications were verified satisfactory. Subsequent investigation found that VA System flow had been unknowingly degraded over the past 5 months. This incident is attributed to a design oversight due to greater than anticipated interaction of the clothes dryer exhaust lint with the Air Flow Monitor Device, and the ineffective alterations to the RP clothes dryer filters to prevent filter bypass. Corrective actions will include modification of the clothes dryer filters, the addition of flow criteria to appropriate ventilation procedures, and a comprehensive review of ventilation system performance. Further introduction of lint to the VA System is being monitored.

BACKGROUND

The Auxiliary Building Ventilation [EIIS:VF] (VA) System is designed to provide a suitable environment for equipment operation and personnel access during both normal and accident conditions. The Auxiliary Building Filtered Exhaust (ABFX) Subsystem consists of two exhaust trains per Unit with associated fans [EIIS:BLO] (ABFXF-1A, 1B and ABFXF-2A, 2B), filters [EIIS:FLT] and duct. An Air Flow Monitor Device (AFMD) (1ABFX-AFMD-1 and 2ABFX-AFMD-1) is located in the common duct downstream of each Unit's ABFX Subsystem and measures the combined flow of each Unit's filtered exhaust trains on the way to the respective Unit vent. There is also a second AFMD (1ABFX-AFMD-2, 2ABFX-AFMD-2) located upstream of each Unit's filters which is used during the flow balance testing (see Figure 1). The VA filters are bypassed during normal operation.

The AFMD consists of a flow straightener section located in the duct with a static pressure tap and velocity pressure pitots arranged to sense velocity pressure in specific quadrants downstream of the flow straightener. The flow straightener occupies the entire duct cross-sectional area. The velocity pitots and static reference produce an average velocity from which the flow is indicated by 1(2)VAP5280 [EIIS:XI], Flow Indicator for 1(2)ABFX-AFMD-1, which are located in the Control Room. This AFMD is used to obtain flow rates for PT/0/A/4450/04A, Auxiliary Building Filtered Exhaust System Performance Test, and PT/0/A/4450/01C, Auxiliary Building Filtered Exhaust Filter Train Performance Test. These tests verify the 18 month surveillance requirement prescribed by Technical Specification 3/4.7.7, Auxiliary Building Ventilation System.

PT/1(2)/A/4450/02, Auxiliary Building Filtered Exhaust System Operability, is a monthly periodic test procedure used by Operations. This procedure verifies the Filtered Exhaust System operates 10 continuous hours with the filtered exhaust heaters [EIIS:EXTR] operating with flow through the HEPA filters and activated carbon adsorbers in order to prevent buildup of moisture in the filter train. Flow, differential pressure (DP) and differential temperature (DT) are recorded at 2 hour intervals during this test to verify a DT greater than 10 deg. F across the filter units. This is performed while in the filter mode in order to meet the monthly surveillance requirement of Technical Specification 3.7.7.

The Action Requirement for Technical Specification 3.7.7 states that with one train of the ABFX Subsystem inoperable, the inoperable train must be restored to operability within 7 days, or the Unit must be in at least Mode 3, Hot Standby, within the next 6 hours and in Mode 5, Cold Shutdown, within the following 30 hours. One of the Surveillance Requirements for this Technical Specification is the verification, at least once per 18 months, of an acceptable pressure drop of less than 8 inches w.g. across the filter unit while operating at a flow rate of 30,000 cubic feet per minute (cfm) ± 10%.

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

Technical Specification 3.0.3 is required to be entered when the Unit is operating in a condition prohibited by Technical Specifications. This condition exists when a Limiting Condition for Operation is not met except as provided in the associated Action Requirements. It requires that within one hour action shall be initiated to place the Unit in a Mode in which the specification does not apply by placing it, as applicable, in:

a. At least HOT STANDBY within the next 6 hours,
b. At least HOT SHUTDOWN within the following 6 hours, and
c. At least COLD SHUTDOWN within the subsequent 24 hours.

On May 9, 1989, with Unit 2 in Mode 5, PT/0/A/4450/04A, Section 12.4, was performed to retest a VA duct section replacement. During this test, the Filtered Exhaust Train 2A flow rate was found below the 30,000 CFM ± 10% required by Technical Specification Surveillance 3/4.7.7. 2ABFX-AFMD-2, (upstream of the filtered exhaust units) was subsequently found to be clogged with lint and was cleaned per Work Request 944 MES on May 12. Filtered Exhaust Train 2A was subsequently retested and found acceptable on May 12. Control Room indication of VA flow rate (based on 2ABFX-AFMD-1) was normal and acceptable at this time. Investigation continued and VA flows were monitored for degradation. Discussions were held in the period from May 9-25 between the Performance Engineer and Component Expert to establish a program for periodic review and cleaning of 2ABFX-AFMD-2. It was determined that a SWR (Standing Work Request) would be required to perform weekly cleaning and inspection. However, due to the time necessary to develop, review, and approve the SWR, a separate work request (7085 PRF) was written on May 25, to perform this work. In the period May 9 until May 21, Unit 2 was in a Mode where VA is not required since the U2EOC2 outage was being completed. The Performance Engineer monitored flow between the cleaning on May 12 and May 25, by qualitative assessment of 2ABFX-AFMD-2. When degradation was becoming apparent on May 25, 2ABFX-AFMD-2 was cleaned. System flow rate during the period of May 12 through 25 was considered sufficient to meet the Technical Specification requirements.

It was determined that the lint was coming from the Radiation Protection (RP) clothes dryers' filters. The end of the clothes dryer filter housing relied on a sheet metal panel on the front of the dryer to prevent lint bypass around the filter screen. This metal to metal contact was judged inadequate since lint was found on the edges of the filter housing where contact is made with the front panel of the dryer. An endcap was fabricated and installed to provide a more positive seal. This was accomplished using a corrective maintenance work request, since the RP clothes dryer filters are not detailed in the equipment manual or on the plant drawings. Since the dryers were not detailed in this manner, any modification to them would be performed under the normal work

request program rather than the more detailed modification program. The RP clothes dryers are Cook Model 207 commercial clothes dryers that are equipped with an exhaust filter housing and fan. Problem Investigation Report (PIR) 2-C89-0211 was written on May 30, 1989 to address the problem of lint bypassing the RP clothes dryer filters. The resolution of PIR 2-C89-0211 included completion of the RP clothes dryer filter alteration on May 31, 1989 and cleaning of 2ABFX-AFMD-2 on a weekly basis per Standing Work Request 11854 SWR. Performance would also monitor the problem to ensure the RP clothes dryers were functioning correctly. Consideration was given to the possibility of lint clogging components downstream of 2ABFX-AFMD-2. However, it was believed that the clothes dryer alteration would eliminate the introduction of lint into the VA System and that the inspection and cleaning of 2ABFX-AFMD-2 would remove residual lint from the system. This belief was supported by the fact that VA flows were adequate at this time. It was expected that any further lint problems would first show up on 2ABFX-AFMD-2, before they might appear on 2ABFX-AFMD-1. These inspections were considered both compensatory action and on-going tests of the component. These inspections in retrospect were inadequate since they were based on the assumption that all residual lint would be caught at 2ABFX-AFMD-2. Also, the effect of increased cleaning allowed lint to propagate past 2ABFX-AFMD-2. The Unit 1 VA Filtered Exhaust System does not receive any input from clothes dryers.

An explanation is needed here as to why the duct work was not cleaned upon discovering that lint was within the duct as well as why it was not determined where the lint was coming from. After the filter was modified in May, it was assumed that the problem of bypass lint was corrected. Therefore, any additional lint that might collect on 2ABFX-AFMD-2 would be residual from the duct work. Since this was expected to be only a small amount and the flow monitor was to be cleaned/inspected each week, the need to clean the duct became a low priority. Also, even though lint was found on 2ABFX-AFMD-2 each week, personnel failed to properly identify the lint on the monitor as new lint because it was believed that the original fix to the filter was effective.

During the five months following the issuance of PIR 2-C89-0211, 11854 SWR was performed weekly to inspect and clean lint from 2ABFX-AFMD-2 and new lint was found during each inspection. The lint found in the subsequent inspections was assumed to be residual lint that was coming off the VA ductwork from the previous RP clothes dryer filter failure. The clothes dryer filters were inspected on at least three occasions without obvious indication of further bypass flow.

EVENT DESCRIPTION

On November 11, 1989 at 0540 hours, the Control Room Operators noticed that 2VAP5280, Flow Indicator for 2ABFX-AFMD-1 (downstream of the filtered exhaust units) was reading approximately 30,000 CFM, which is approximately half of the normal flow. Unit 2 was in Mode 1, Power Operation, at the time of discovery.

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This problem was turned over to the day shift at 0700 hours. The day shift investigated the low flow indication by checking the VA System alignment and inspecting the VA discharge duct. The Filtered Exhaust Fans were run in different combinations to determine the effect on 2VAP5280, which was found to read approximately 18,000 CFM with either Filtered Exhaust Fan off. At 1310 hours, Work Request 45330 OPS was written to investigate and repair the reason for 2VAP5280 reading low. The Ventilation Performance Engineer was also consulted to take a local reading at 2ABFX-AFMD-1 with a manometer to verify the 2VAP5280 reading. The local reading with the manometer also indicated approximately 30,000 CFM. Therefore, the Unit 2 VA System was declared inoperable at 1740 hours and Unit 2 entered Technical Specification 3.0.3. The 12 hours between discovery and declaration of inoperability was reasonable in this case when consideration is given to the actions taken at that time. When the shift discovered the low flow indication it was on a non-safety gauge which required additional evaluation to determine operability. The evaluation process started by aligning VA in different ways to determine if the low flow was due to alignment. When no problems were found, the Ventilation Performance Engineer was called in to help. It was a Saturday and took some time to get the necessary support staff. The Performance Engineer required some time to evaluate performance, using a locally installed manometer to evaluate the data. Once the Performance review confirmed the actual flow was low, the Unit 2 VA System was declared inoperable and actions were taken to correct the condition. By 1755 hours, ABFX-2A and 2B were removed from service per Tagout Removal and Restoration (R&R) 29-2539 and work commenced to inspect and clean Air Flow Monitor Device 2ABFX-AFMD-1. The air flow monitor was found with approximately one third of the flow straightener openings clogged with lint from the RP clothes dryers. By 1812 hours, the AFMD had been cleaned and the Unit 2 filtered exhaust fans were returned to service. At 1825 hours, Technical Specification 3.0.3 was exited after all flows and indications were verified satisfactory following the cleaning per Work Request 45330 OPS. Review of Unit Vent stack flow data before and after cleaning 2ABFX-AFMD-1, indicates that the filtered exhaust flow had decreased by approximately 15,000 CFM, instead of 30,000 CFM as indicated by 2ABFX-AFMD-1, due to the lint blockage. This is due to clogging of the instrument lines causing a lower than normal flow indication problem.

After the completion of cleaning, Maintenance Engineering Services (MES) and Performance Engineers investigated the RP clothes dryer filter and found that the previous modification to prevent the filters from lifting in their filter housings had not corrected the filter bypass problem. It was found that the modification to prevent the filter from lifting caused the edges of the filter to deform under flow conditions.

After the discovery of lint accumulation, Standing Work Request 14069 SWR was initiated to perform weekly inspection and cleaning of air flow monitor device 2ABFX-AFMD-1. Weekly inspection and cleaning is still being performed on 2ABFX-AFMD-2 per 11854 SWR.

CONCLUSION

This incident has the following causes:

Root Cause: Design oversight due to unanticipated interaction of systems/components.

Contributing Cause:

(1) Inappropriate action (action taken was not best alternative) because of faulty assumptions.

(2) Inappropriate action (no action taken when required because need was not recognized) in failing to properly monitor downstream components.

This incident is attributed to a design oversight due to greater than anticipated interaction of the RP clothes dryer exhaust and the air flow monitor. The interaction of this non-safety related component (clothes dryer) with the safety related portion of the VA System was not adequately considered in the original system design. Inadequate evaluation of the previous problem (May 31, 1989) did not fully eliminate the source of lint. Although the Cook Model 207 clothes dryers are equipped with exhaust filter housings, they were not originally designed to remove all the lint exiting the dryers. These dryers have been installed since startup, and lint has accumulated in the VA duct between the clothes dryer filters and the air flow monitors over time. The air flow monitor flow straightener located in the duct consists of many tubes that can become clogged with lint, thereby reducing the total flow. Had a more thorough evaluation of the May 31, 1989 occurrence taken place, the following contributing causes would not have been a factor.

The original design oversight allowed the subsequent filter alteration to be performed outside the established modification process and thus contributed to less than adequate design, review, and testing of the alteration. Had this interface been adequately described in design documentation, a formal modification would have been initiated with a more thorough review. Post-modification testing requirements would likewise have received greater scrutiny and more thorough testing would have been performed to ensure that the modified filters were performing effectively.

A contributing cause is inappropriate action (action taken was not best alternative) due to the faulty assumptions made after the filter alteration. First, it was assumed that the altered filters would prevent further addition of lint to the VA System. Second, it was concluded that the lint found in subsequent cleaning was residual lint dislodged from the duct walls and not new lint from the dryers. Given these conclusions, it was believed that the weekly cleaning of 2ABFX-AFMD-2 was removing residual lint from the system and

consequently further cleaning of the ductwork was given a low priority. It was believed that weekly inspection/cleaning of 2ABFX-AFMD-2, combined with inspection of the altered filter (on at least three occasions without obvious signs of further bypass flow), provided adequate assurance that downstream VA System components were not adversely affected. Thus, a second contributing cause of inappropriate action (no action taken when required because need was not recognized) is identified. Other personnel consulted during the investigation for PIR 2-C89-0119 (concerning VA duct cracks) also agreed with this conclusion. For this reason, this incident will be reviewed with other station technical support staff for awareness to prevent recurrence.

Investigation by Maintenance Engineering Services and Performance personnel following the November 11, 1989 incident found that the previous clothes dryer filter alteration per 7036 PRF had not corrected the bypass leakage of the dryer exhaust because restraint of the ends of the filter that was previously lifting caused the perpendicular sides of the filter to deform while the clothes dryer exhaust fan was in operation. The clothes dryer filters have since been modified to provide stiffeners on all sides of the clothes dryer filter screen to eliminate this problem (per Exempt Variation Notice, CEVN-2694). The installation of a back-up filter rack in the common exhaust duct of the RP clothes dryers is being evaluated by Design Engineering as part of the permanent solution to this problem.

The possibility of lint clogging components downstream of 2ABFX-AFMD-2 was considered in June of 1989. However, it was believed that the RP clothes dryer filter alteration would eliminate the introduction of lint into the VA System, and that the inspection and cleaning of 2ABFX-AFMD-2 was removing residual lint from the system. VA flows were adequate at this time, indicating that 2ABFX-AFMD-1 was not affected and the retest performed, per PT/0/A/4450/04A, on May 12, 1989 had indicated adequate system flows. Since the downstream components had not been affected when 2ABFX-AFMD-2 had previously become clogged with lint, it was concluded that 2ABFX-AFMD-2 would stop all the lint. It is speculated that the increased flow and the disturbances caused by the weekly inspections and cleaning may have caused lint to propagate past 2ABFX-AFMD-2.

Since the problem with lint blockage on 2ABFX-AFMD-1 has been identified, the effect of lint on further downstream components has been reconsidered. Components downstream of 2ABFX-AFMD-2 that have been considered as potentially being affected by lint are the filtered exhaust filter train prefilters, the filter train inlet and bypass dampers, the Unit 2 vent air flow monitor, and the Auxiliary Building and Unit Vent EMFs [EIIS:IL]. The filter dampers and prefilter grids have been inspected and found to be unaffected by lint accumulation. The filter train Differential Pressures have not degraded during filter operation and will be monitored. Low flow alarms will be received if the EMFs are affected by the introduction of lint and degradation has not previously been identified. The Unit Vent air flow monitor does not have a flow straightener section, but periodic cleaning will be initiated to insure that the pitots are not blocked.

Past Inoperability Review

A relatively long period of time passed before the reduced flow on the Unit 2 filtered exhaust fans was recognized. A review of PT/2/A/4450/02 from May to November, 1989 produced the following flows:

Date	Flow (2VAP5280, CFM)
5/13/89	56,000
6/10/89	57,000
7/7/89	50,000
8/5/89	44,000
9/2/89	41,000
9/30/89	36,000
10/27/89	31,000
11/25/89	58,000

This data indicates that the recorded exhaust flow from the Unit 2 filtered exhaust fans fell below the Technical Specification limits sometime between June 10 and July 7, 1989. It should be noted that the purpose of this test is to establish and verify flow through the HEPA filters and activated charcoal adsorbers in order to prevent moisture build-up in the filter train. The test procedure does not provide specific guidance on acceptable flows and the Operators performing the test did not notice that the flows were low since this was not a part of the acceptance criteria. This PT and other similar ventilation PTs and the operating procedure for VA are being revised to reflect the appropriate flow range to aid in the identification of abnormal indications. Unit 1 flows during the past year, recorded in PT/1/A/4450/02, were verified to be normal.

The low flow indication also was not detected for a five month period during the control board reviews during each shift turnover. The relatively slow degradation of flow may have led personnel to overlook the existence of a continued trend. There are no alarms for low flow. In order to prevent recurrence of this problem, Operations has emphasized attention to Control Room indications in the monthly Shift Supervisor meetings and this will be reemphasized in the Operator proficiency training. Also, Operating Procedures and periodic tests are being revised to include expected flow ranges and differential pressures for all ventilation systems.

A systematic review of Control Room indications and controls will be conducted to determine if Operators have received proper training and have good understanding of the function of controls and guages.

During the past 13 months there have been two previous Technical Specification 3.0.3 entries due to inoperability of ventilation systems (see LER 413/88-023 and LER 413/89-023). LER 413/88-023 involved the inoperability of the Control

Room Ventilation System [EIIS:UC] (VC) due to a design deficiency regarding the selection of a manual chiller [EIIS:CHV] lube oil temperature control valve [EIIS:V]. LER 413/89-023 involves inoperability of both trains of the Control Room Ventilation System due to an incomplete pre-operational test procedure. These incidents did not involve the VA System, however operability of ventilation systems due to design deficiencies is a recurring problem. As stated earlier in this report, 2ABFX-AFMD-2 was discovered to be clogged with lint in May 1989, therefore lint introduction into the Unit 2 VA System is a recurring problem. Since this is a recurring problem, the planned corrective actions include monitoring the previously affected AFMDs and inspection of the Unit 2 Vent AFMD. Periodic inspection of other AFMDs on safety related ventilation systems is being evaluated. A search of the INPO Database did not show any similar cases.

CORRECTIVE ACTION

SUBSEQUENT

1) The design review and the design basis documentation effort is in progress and should prevent the problem of design deficiencies from recurring. This review and documentation effort may produce additional design deficiencies that will be reported as necessary.

2) 2ABFX-AFMD-1 was inspected and cleaned per Work Request 45330 OPS on November 11, 1989.

3) Standing Work Requests 14069 SWR and 11854 SWR have been initiated to perform weekly inspections of 2ABFX-AFMD-1 and 2ABFX-AFMD-2.

4) Each Operations shift is performing increased surveillance of 2VAP5280 until the lint problem has been corrected, as of November 21, 1989.

5) On December 7, 1989, MES and Performance inspected the Inlet, Bypass and Isolation dampers for Train 2A and 2B filtered exhaust units to ensure lint accumulation had not affected the ability of the dampers to close and found no lint accumulation in the dampers. A prefilter screen inspection was also performed.

6) This incident was covered in the monthly Shift Supervisors meeting to reinforce the need to initiate corrective action for abnormal indications, on December 8, 1989.

7) On December 7, 1989, the dryer filter cleaning frequency was changed to after every load pending the completion of the Interim Modification.

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PLANNED

1) As an interim measure, the RP clothes dryer filters were modified on December 8, to prevent bypass leakage per Exempt Variation Notice CEVN-2694. Dryer operation will be observed to verify the filters are no longer deforming.

2) The VA duct between the RP clothes dryers and 2ABFX-AFMD-2 will be cleaned, as access permits, per Work Request 7305 PRF following the RP clothes dryer filter modification per CEVN-2694.

3) The VA duct between 2ABFX-AFMD-2 and 2ABFX-AFMD-1 will be cleaned and inspected following the cleaning of VA duct upstream of 2ABFX-AFMD-2 per Work Request 7325 PRF.

4) Weekly inspections of 2ABF-AFMD-1 and 2ABFX-AFMD-2 will continue until the effectiveness of the RP clothes dryer filter modification and any subsequent modifications have been verified. Inspection frequency will be re-evaluated at that time.

5) The Unit 2 Unit Vent Air Flow Monitor will be periodically inspected until the performance of the modified clothes dryer filters has been proven adequate.

6) Flow criteria will be added to the appropriate ventilation procedures in order to alert the Operators of discrepancies in flow.

7) Procedures will be revised to provide documentation of control board review for abnormal indications and notification of supervision.

8) A systematic review of Control Room indications and controls will be conducted to determine if Operators have received proper training and have good understanding of the function of controls and guages.

9) Cleaning and/or inspection, as appropriate, of all air flow monitors for dust and lint accumulation on safety related ventilation systems will be conducted annually.

10) A permanent solution to correct the interaction between the RP clothes dryers exhaust and the Unit 2 VA System will be developed by Design Engineering and Catawba Station personnel. Proper control of this interface will be achieved either through further modification or other steps. The RP clothes dryer filters will be evaluated for inclusion in design documentation. The installation of a backup filter to be installed between the clothes dryers and the VA duct will be evaluated.

11) All inputs to the VA System will be evaluated by Design Engineering to determine whether further potential foreign matter inputs to the VA System should be addressed.

As a result of the identified recurring problem associated with ventilation system problems involving design deficiencies, a three part, comprehensive response has been initiated.

12) Part 1-Immediate

Operations, with appropriate consultation with the System Expert and Design Engineering, will review plant indications of all safety-related ventilation system performance to ensure that all Technical Specification requirements are being met. Any discrepancies in ventilation system indications will be promptly evaluated and resolved. A review of abnormal indications in the Control Room has been performed. A systematic review will be performed involving Operations, Section Managers, and the Production Support Department, so that training can be provided with respect to abnormal indications.

13) Part 2-Short Term

The Performance Group, working with Operations and Design Engineering personnel, will review available plant parameters for addition to the Performance Monitoring Database System to enhance the analysis and trending of ventilation systems (as well as other systems) performance data. This will provide better assurance of proper overall system performance, as well as specific surveillance compliance, and a historical perspective of performance over time.

This enhancement will more closely tie the effective use of system performance data with data generation, e.g. monthly system operation data used to supplement periodic surveillance results.

14) Part 3-Near Term

Design Engineering will initiate a thorough and systematic review of ventilation system design requirements and compare them against nominal operating data to ensure consistency with the FSAR and Technical Specification parameters.

15) Issue a memorandum to the technical support staff in Maintenance, Operations and Technical Services, to emphasize evaluation of the affect of corrective maintenance on associated components using this incident as an example.

SAFETY ANALYSIS

The Catawba FSAR, describes the Auxiliary Building Filtered Exhaust System as follows:

"The Auxiliary Building Exhaust System consists of two filter trains with fans, two 100 percent capacity preheater/demister sections and associated ductwork for each unit. This system serves areas of the Auxiliary Building that are subject to potential contamination. This system serves an engineered safety features function during accident conditions.

The Auxiliary Building Filtered Exhaust System serves both a non-safety and a safety related function. During normal plant operation the two filter trains and fans for each unit operate as two-50 percent capacity components of the Filtered Exhaust System for its respective unit. Each filter train is equipped with a bypass section with the normal mode of operation being in the bypass position. Radiation monitoring is provided upstream of filter trains and in the unit vent. Upon indication of high upstream radiation, the bypass dampers will automatically close and the filter train inlet dampers will automatically open to direct air flow through the filter train. During normal operation, high unit vent radiation will shut down the Filtered Exhaust, Unfiltered Exhaust and Supply Systems.

During accident conditions the two filter trains, fans, and preheater/demister sections for each unit will operate as two-100 percent capacity subsystems of the Filtered Exhaust System for its respective unit. Upon receipt of a signal, isolation dampers will close, shutting off air flow from all areas of the Auxiliary Building except for the rooms which contain safety related pumps which are part of the Emergency Core Cooling System (ECCS). One of the two 100 percent capacity exhaust ducts will exhaust air from the pump rooms through the associated preheater/demister section, filter train, and fan to the unit vent. This assures the integrity and availability of one train of the Filtered Exhaust System in the event of any single active failure.

During normal plant operation the air flow rate through each filter train in approximately 30,000 cfm. During accident conditions the air flow rate through each filter train is reduced to 6,540 cfm (Unit 1 side) minimum and 6,230 (Unit 2 side) minimum."

Catawba Tech Spec 4.7.7.d.3 requires that each train of the VA System be verified capable of maintaining the ECCS pump rooms at a negative pressure relative to adjacent areas.

Tech Spec 4.7.7.b.3 requires that each train of the VA System be verified as achieving a system flow rate of 30,000 cfm ± 10% per train.

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

When the VA System receives a safety signal, a) the non-essential headers isolate, b) damper 1(2)ABF-D-17 opens to provide exhaust from the ECCS pump rooms, c) the vortex dampers on the filtered exhaust fan suction close to allow approximately 6000 CFM per train, and d) the unfiltered exhaust fans and supply units trip. In this configuration total system flow will be 12,000 CFM rather than the normal 60,000 CFM. Since flow is related to the static pressure drop across any obstruction, whether a manual volume damper or unintentional obstruction (such as the case being addressed), the impact of the blockage at the AFMD on system flowrate would have been significantly less in the accident mode compared with full flow. Whereas in the normal mode of operation, the reduction in air flow caused by the lint blockage was (conservatively) 50%, while in the accident mode, the total decrease in total air flow would have been significantly less than 50%. Therefore, the system would have been capable of achieving a net air outflow from the ECCS pump rooms.

During post-accident recovery, the VA System is realigned to provide full exhaust flow for environmental qualification concerns, i.e., to maintain a mild temperature in the Auxiliary Building. The VA supply units and associated cooling water flow, and Unfiltered Exhaust Fans would be unaffected by any reduction in Filtered Exhaust Fan flowrate, thereby providing temperature control of the Auxiliary Building. With respect to Auxiliary Building Negative Pressure, even (conservatively) assuming a filter unit flow of 30,000 CFM, a differential of 10,000 CFM of exhaust flow (both filtered flow and unfiltered flow) above the supply flow would have existed for the Unit 2 VA System. Also, the Unit 1 VA System was unaffected by the inoperability of the Unit 2 VA System (both Units of the VA System communicate freely with the Auxiliary Building). Auxiliary Building negative pressure and environmental control would have been accomplished. Since there is no point in the accident or post-accident recovery operating configuration in which the Auxiliary Building would have been at a positive pressure, the VC (Control Room Ventilation System) would have been unaffected. The VC System provides Control Room positive pressure to prevent the spread of radioactivity into the Control Room from the surrounding areas, one of which is the Auxiliary Building. Also, as mentioned in Section 15.6.5.3 of the Catawba FSAR, the offsite dose analysis for a postulated large break LOCA does not take credit for VA System filtration of ECCS pump room environment.

The VA System became technically inoperable (per Tech Spec 4.7.7.b.3) some time between 6/10/89 and 7/7/89, assuming an equal split of flow between trains. If the flows were not equally split, it is possible that only one train of VA was inoperable for some finite time period before both trains became inoperable. The AFMD blockage involved a partial blockage of the velocity pressure sensing ports. The indicated flows were thus conservative, and actual flows were likely higher. Evaluation using the fan laws indicates that the likely system flowrate was approximately 46,000 CFM on 10/27/89 rather than the recorded 31,000 CFM (based on change in filter unit DP). It is most conservative, however, to assume that the actual minimum flow was closer to the indicated value 30,000 CFM recorded on Work Request 45330 OPS at the time of discovery.

This evaluation has concluded that the VA System safety related function was continuously maintained; i.e. the ability to maintain a negative pressure in the ECCS pump rooms was never degraded.

The following is part of the Past Operability Evaluation for PIR 2-C89-0347, provided by Design Engineering:

"The VA System is designed to provide the normal ventilation and heating requirements, and the emergency (accident) exhaust requirements for the Auxiliary Building. Auxiliary Building supply and unfiltered exhaust subsystems are not nuclear safety related (i.e., not QA Condition 1). A portion of the filtered exhaust subsystem, providing filtration of the ECCS pump rooms, is an engineered safety feature. As such, the filtered exhaust subsystem is required to be operable in Modes 1, 2, 3, and 4.

The problem identified in this PIR did render the VA System inoperable with respect to Technical Specification requirements because of the inability of the system to achieve the required flow rate of 30,000 cfm ± 10% (reference Technical Specification Section 4.7.7). However, the safety significance of this is extremely low. The Technical Specifications are written to verify system parameters under the most severe operating conditions. For VA System flow rate, the worst condition is in the normal plant operating alignment. The required emergency flow rate is much less (~6500 cfm). Therefore, not meeting the Technical Specification surveillance requirement does not indicate a degraded safety function in this situation.

Design Engineering has determined that, while inoperable per the Technical Specifications, the VA System would have performed its intended safety function for the following reasons:

1) While normal flow was degraded from ~30,000 cfm (per fan) to ~15,000 cfm (per fan), the emergency flow would have decreased by an insignificant amount (<1%). Calculation CNC-1211.00-00-0089 shows that if the normal flow decreased from 30,000 cfm to 15,000 cfm, the effect on the emergency flow would have been a decrease from 6540 cfm to approximately 6500 cfm. This flow is adequate to negatively pressurize the ECCS pump rooms and, therefore, filter all air exhausted from these rooms.

2) The VA System would be able to perform its non-safety post-accident functions in the degraded condition described in the PIR. During post-accident recovery, the VA System is realigned to its normal configuration in order to provide environmental control (i.e., temperature control) and negative pressurization. The VA supply units and associated cooling water flow, and the unfiltered exhaust flow

rate. Also the Unit 1 VA system was unaffected by the inoperability of the Unit 2 VA system. Since both Units of VA communicate freely within the Auxiliary Building, air flows would have been only minimally affected. Therefore, the Auxiliary Building negative pressure and environmental control would have been accomplished.

3) There is no point in the accident or post-accident recovery scenarios where the Auxiliary Building would have been at a positive pressure because exhaust flow rates always exceed supply flow rates. Supply air to the Auxiliary Building is 132,960 cfm (from both trains of both units). The total exhaust is 201,400 cfm (unfiltered exhaust - 81,400 cfm, filtered exhaust - 120,000 cfm). If the filtered exhaust was decreased by 30,000 cfm, as was the case in the subject PIR, exhaust would still have exceeded supply by 38,440 cfm. This would maintain the Auxiliary Building negatively pressurized. (Reference flow diagrams CN-1577-1.0 and CN-1577-1.2 for indicated flow rates.) Keeping the Auxiliary Building negatively pressurized would prevent any adverse impact to the Control Room Ventilation (VC) System and would prevent an unmonitored release of radiation.

4) The health and safety of the public were not affected by this event. As stated in Section 15.6.5.3 of the CNS FSAR, no credit is taken for the VA system filters for ECCS leakage. Therefore, even if the VA system had not maintained a negative pressure in the ECCS pump rooms, no increase in off-site or operator dose would have occurred."

FIGURE 1

SCHEMATIC OF UNIT 2 FILTERED EXHAUST