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DUKE POWER

November 23, 1988

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

Subject: **McGuire Nuclear Station**
Docket Nos. 50-369 and 50-370
Response To Request For Additional Information
Regarding Duke's Request For Extended Outage Time
For The VC/YC System Modification (TACs 65649 and 65650)

Gentlemen:

Pursuant to your letter of September 1 1988, find attached the subject information requested.

Should there be any questions, please contact S.E. LeRoy at (704) 373-6233.

Very truly yours,

Hal B. Tucker

xc: Mr. M.L. Ernst
Deputy Administrator, Region II
U.S. Nuclear Regulatory Commission
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Mr. Darl Hood
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Washington, D.C. 20555

Mr. P.K. Van Doorn
NRC Resident Inspector
McGuire Nuclear Station

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The NRC requested the following information:

Question No. 1

Discuss the controls for the VC system dampers. Justify the proposed change in terms of the potential for, and the consequences (i.e., personnel exposure) of, failure of the damper in the recirculation line which influences flow to the system filters. Include all failure modes (open, closed, partially closed). To what extent can damper failure affect operator doses due to lowered differential pressures (i.e., recirculation damper fails open) or increased flows (i.e., damper fails closed)?

Duke's Response

Background:

There are two Nuclear Station Modifications (NSM) presently in the design phase, both of which are intended to increase the reliability of the VC system. Each involves hardware changes and do not involve system function changes.

NSM MG-11905 involves replacing eight damper/actuator assemblies which are used to isolate the two 100% redundant Outside Air Pressure Filter Trains (OAPFT). Each OAPFT contains four (4) isolation dampers each positioned with electro-hydraulic actuators. These eight assemblies (Tag No.'s CR-OAD-1 thru CR-OAD-8) are each to be replaced with a Nuclear Grade Stainless Steel Damper complete with spring-return pneumatic piston actuators, and limit switches.

As a result of this review, the scope of NSM MG-11905 will be amended as follows. Recirculation line dampers CR-OAD-2 and CR-OAD-6 will be removed from service and replaced with duct sections. The recirculation line flow will be verified by periodic testing under different failure conditions to assure flow in this line is toward an active filter train and away from an unfiltered path to the control room at the same time maintaining Control Room pressurization.

NSM MG-52009 involves replacing two (2) 50% capacity fans that presently serve each of two (2) Outside Air Pressure Filter Trains with one (1) 100% capacity nuclear grade fan. As a result of these fan replacements, two isolation dampers (Tag No.'s CR-OAD-4 and CR-OAD-8) presently located at each deleted fans' discharge will also be removed.

Duke plans to implement NSM MG-11905 prior to implementation of NSM MG-52009.

The proposed Technical Specification change has been submitted requesting additional allowed outage time to implement NSM MG-52009 and MG-11905. All discussion that follows is based on the system alignment after modifications MG-52009, and MG-11905 (as amended) are implemented.

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Reference Documents:

Manufacturers Drawings:

MCM-1211.00-221	Controls Schematic
MCM-1211.00-1927	Damper Assembly Drawing
MCM-1211.00-1935	Fan Assembly Drawing

Duke Drawings:

MCEE-131-00 Series	Control Elementary
MCEE-231-00 "	Control Elementary

Duke Calculations:

MCC-1227.00-00-0002 Rev.1	Control Room LOCA Dose

FSAR Paragraphs:

FSAR Section 6.4
FSAR Section 3.2.3-1
FSAR Section 7.1.2
FSAR Section 7.6.10

Standards, Regulatory Guides, etc.,:

13th AEC Air Cleaning Conference, Nuclear Power Plant Control Room Ventilation System Design For Meeting General Design Criteria 19, K.G. Murphy, Dr. K. M. Campe

Standard Review Plan- Section 9.4.1, " Control Room Area Ventilation System," Rev. 2, 1981

Code of Federal Regulations, Title 10, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," 1982

Regulatory Guide 1.52

ANSI N509-1980

ANSI N510-1980

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Control Review:

Overview:

Modification MG-11905 will not change the VC system isolation damper control logic. Only the method of control will change, and the actuator reliability will be increased.

The controls for the Chilled Water (YC) and Control Area Ventilation (VC) Systems are on the HVAC control board in the Main Control Room. These systems are combined to form one system, the VC/YC system which is designed to provide HVAC to the Control Room and Control Room Area using redundant trains of equipment.

The equipment alignment is achieved by using two primary selector switches: the TRAIN KEY SELECTOR and the CHW ALIGN pushbutton. The TRAIN KEY SELECTOR selects which train will be operational, "A" or "B". See Table 1.

During a Blackout or LOCA the Emergency Safety Features Actuation System (ESFAS) will automatically start both OAPFT fans, independent of the TRAIN KEY SELECTOR SWITCH, and open their associated isolation dampers.

The above control logic has not been changed by either NSM described in the background section.

Specifics:

During normal plant operation, the isolation dampers associated with both filter trains are in the closed position. The dampers which are being replaced, are presently positioned by ITT hydramotor actuators, Model NH96. These actuator motors run continuously to maintain the closed position causing early failure of the gaskets and seals within the actuator assemblies.

The replacement dampers will be positioned by an air driven cylinder type actuator that gives positive remote quarter-turn (90 Deg.) control. The actuator was bought as a Nuclear Safety Related component capable of producing a minimum of 1.25 times the torque required to fully seat the damper. The operators are fail-safe spring-return type designed to open the damper upon loss of operating air pressure. An ASCO Model NPK832061V electric solenoid valve controls the control air signal. Upon Filter Train Fan actuation, one solenoid valve is de-energized causing air to be relieved from two (2) associated isolation damper actuators allowing the dampers to spring open.

Each damper/actuator assembly is complete with two limit switches as manufactured by Namco, Model EA180. One limit switch is used to indicate the closed damper position, while the second indicates the open position.

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After the fan modification is complete there will be two (2) isolation dampers per filter train. Both open-indicating limit switches are wired in series, such that both dampers must be open for the control room indicating light to actuate. Similarly two dampers must be closed for the closed light to actuate.

Potential:

Each of the dampers which serve one (1) of two (2) 100% capacity OAPFTs are controlled from a common air line. This air line signal is controlled from a single electric solenoid valve such that when the associated OAPFT fan is off, the solenoid valve is energized allowing air to both damper actuators. The dampers are piston driven by air filling the actuators, forcing the damper to the closed position.

The failure analysis that follows will review all credible damper, damper actuator, and VC system component failures and consequences thereof. The discussion will include control air failure, power failure, and individual component failure.

Specifically for the isolation dampers in question (CR-OAD-1, CR-OAD-3, CR-OAD-5, and CR-OAD-7) a control air failure would result in all four (4) isolation dampers to spring return to the open damper position. As indicated from the above description, a solenoid failure, a control air, or power failure will cause both isolation dampers, which serve the affected OAPFT, to open. Because of this control logic, only a mechanical failure in one damper/ actuator would allow it to hang-up in the partially open or closed position when the remaining damper is open. This is a highly unlikely event considering the spring-return type actuator design.

Consequences:

The Control Room ventilation system (See attached partial VC flow diagram fig. 1) is one of several subsystems which make up the VC system. The ventilation system provides make-up air through four air vents at two locations on the Auxiliary building roof. Filtering capability is provided by two redundant pressure filter trains (OAPFT-1, and OAPFT-2).

The ventilation system is designed to meet all applicable criteria as specified in Appendix A to 10CFR Part 50. General Design Criteria 21 and Standard Review plan Section 9.4.1 requires that redundancy and independence be designed into the protection system.

Listed below are different postulated fan, damper, and system failures and the consequences thereof as requested.Partially open positions were not evaluated since no partially open position constitutes a worst dose case. The consequences of a partially open failure are enveloped by the damper fail closed and oper cases which are discussed in detail.

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Failure Analysis:

Case 1 - Single Train "A" Power Failure:

A single failure of the plant power system, specifically motor control center 1EMXH results in the system alignment shown as Case 1 in Table 1, and Figure 2. Motor control center 1EMXH powers CRA-OAPFT-1 heaters and fan, as well as control room air handling unit train "A" fan. Power panel board EKA is fed from MCC 1EMXH and powers the controls associated with CRA-OAPFT-1. Loss of 1EMXH causes the loss of EKA, resulting in the OAPFT fan and its associated isolation damper solenoid valve to lose power. The de-energized solenoid valve causes the isolation dampers to spring return to the open position.

As a result of the train "A" power failure, filter train "A" is inoperable. Filter train "B" is operable and will provide 2000 cfm +10% of filtered air to the control room. As shown in Figure 2, some recirculation air flow from the inoperable train will occur.

Results:

Based on 1000 cfm of outside air and 1000 cfm of recirculation air processed through the operable filter train, Duke Calculation MCC-1227.00-00-0002 Rev.1 predicts a control room LOCA dose of 0.34 Rem whole body and 18.0 Rem thyroid.

The dose under Case 1 conditions will very slightly from the calculated values, but will always be under the design basis allowables of 5 Rem whole body and 30 Rem thyroid with the following flows:

1) Operable filter train flow rate of 2000 cfm +10% is maintained; and,

2) Control room pressurization of 1/8 inch w.g. relative to the outside air is maintained.

Case 2 - Single Train "B" Power Failure:

A single failure of the plant power system, specifically motor control center 2EMXH results in the system alignment shown as Case 2 in Table 1, and Figure 3.

As a result of a train "B" power failure, filter train "B" is inoperable. Filter train "A" is operable and will provide 2000 cfm +10% of filtered air to the control room.

Results:

Same as Case 1 above.

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Case 3 - Single Mechanical Fan Failure Train "A" OAPFT:

A single mechanical failure of the Train "A" OAPFT fan results in the system alignment shown as Case 3 in Table 1 and Figure 4.

This fan failure results in the loss of filter train "A" operability. Filter train "B" is operable and will provide 2000 cfm +10% of filtered air to the control room. The filter train will receive recirculation air from the train "B" return air duct as well as the train "A" return duct. Upon receipt of an ESFAS, outside air is provided from two physically separated intakes. High radiation detection, or high chlorine detection will automatically close the affected intake. If both intakes close, the operator will chose the least contaminated as a source of air for pressurizing the control room.

Results:

As in Case 1, pressurization to 1/8 inch w.g. is maintained, flow rate through the operable filter train is maintained at 2000 cfm +10%, and the dose will be under the design basis allowable. Control room habitability will be maintained.

Case 3A - Control Air Failure:

A control air failure would result in dampers CR-OAD-1,3,5, and 7 opening to the "fail safe" position independent of the associated fan status. This damper alignment will not effect the control room dose. However, a control air failure coupled with a single fan failure will result in the same system alignment as either Case 3 or 4 depending on the fan involved.

Results:

Same results as Case 3.

Case 4 - Single Mechanical Fan Failure Train "B" OAPFT:

A single mechanical failure of the train "B" OAPFT fan results in the system alignment shown as Case 4 in Table 1 and Figure 5.

As the result of a train "B" power failure filter train "B" inoperable. Filter train "A" is operable and will provide 2000 cfm +10% of filtered air to the control room.

Results:

Same results as Case 3.

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Case 5 - CR-OAD-1 Mechanically Fails Closed:

Mechanical failure of damper CR-OAD-1 to the closed position results in the system alignment shown as Case 5 in Table 1, and Figure 6.

This failure removes CR-OAPFT-1 from use as a source for filtered air. Redundant filter train CR-OAPFT-2 would provide 2000 cfm +10% of filtered air to the control room.

Results:

Control room habitability is maintained and control room dose remains below the design basis allowables, since the control room is pressurized to +1/8 inch w.g. and the operable filter train flow rate of 2000 cfm +10% is maintained.

Case 5A - CR-OAD-3 Mechanically Fails Closed:

Results:

Same results as Case 5.

Case 6 - CR-OAD-5, or CR-OAD-7 Mechanically Fails Closed:

Mechanical failure of one of the above dampers results in the system alignment shown as Case 6 in Table 1, and Figure 7.

This failure removes CR-OAPFT-2 from use as a source of filtered air. Redundant filter train CR-OADFT-1 would provide 2000 cfm +10% of filtered air to the control room.

Results:

Same results as Case 5.

Additional Information:

The following dampers were not specifically addressed in the NRC request, but will be discussed for completeness.

Redundant smoke purge isolation dampers align to the "fail safe" closed position during an ESFAS. These dampers isolate the smoke purge exhaust fan on both the suction and discharge. A single damper failure will have no impact on the filter trains ability to pressurize the control room.

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Damper CR-D-5 is located in a "T" shaped duct section. It's position is dependent on which control room air handling unit is operating. The damper does not have a closed position, only an "A" and "B" train position.

Question No. 2

Discuss the surveillance frequency and design provisions for the detection of a failure or change in position of a VC system damper. What procedures would be followed if such failure/position change were to occur?

Duke's Response

Filter Train System Surveillance:

Surveillance Requirements:

The control area ventilation system is subject to periodic testing as described in the station Technical Specification Section 3/4.7.6. These surveillance requirements are attached. The system design does not use control room alarms to alert the operator to damper or fan malfunctions, but relies on the periodic testing of the system to assure operability in the event the system is needed. Fan and isolation damper status lights are provided in the control room.

Although the periodic tests which are performed to meet the surveillance requirements do not specifically address damper position verification, surveillance requirement 4.7.6 e. (see attached) addresses verification of flow through the outside air pressure HEPA filter and charcoal absorber, as well as verification of control room pressurization.

The control area ventilation performance test PT/0/A/4450/08C will be upgraded to include verification of pressurization and flow under a worst case failure scenario (cases 3 and 4). Verification of the flow direction in the idle recirculation line will also be performed under Case 3 and 4 conditions.

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Conclusions

From the cases reviewed in the failure analysis it has been determined that with one operable filter train, filtered air is always available to provide the design requirement of 2000 cfm +10% and maintain the control room at a positive pressure of greater than or equal to 1/8 inch w.g relative to the outside atmosphere; therefore, control room habitability is maintained.

1) Any single damper, fan or power failure will not increase operator dose above the design basis allowables;

2) Verification of damper positions, verification of system flow, and verification of control room pressurization are critical. System operability is verified through periodic testing. (See attachments and page 8 surveillance requirements for test descriptions.); and,

3) Existing periodic tests which verify filter train operability and control room pressurization will be updated to include testing under the worst case failure scenario, Cases 3 and 4.

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TABLE 1

SINGLE FAILURE ANALYSIS
DAMPER AND FAN ALIGNMENT

COMPONENTS	FAILURE CASES					
	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6
	TRAIN A COMPONENTS					
CRA-OAD-1	O	O	O	O	O	O
CR-OAD-1	O	O	O	O	C	O
OAPFT FAN A	OFF	ON	OFF	ON	ON	ON
CR-OAD-3	O	O	O	O	O	C
CR-D-1	C	O	O	O	O	O
AHU FAN A	OFF	ON	ON	ON	ON	ON
CR-D-6	O	O	O	O	O	O
CR-D-4	C	O	O	O	O	O
	TRAIN B COMPONENTS					
CRA-OAD-2	O	O	O	O	O	O
CR-OAD-5	O	O	O	O	O	C
OAPFT FAN B	ON	OFF	ON	OFF	ON	ON
CR-OAD-7	O	O	O	O	O	O
CR-D-2	O	C	O	O	O	O
AHU FAN B	ON	OFF	ON	ON	ON	ON
CR-D-7	O	O	O	O	O	O
CR-D-3	O	C	O	O	O	O

LEGEND: O-OPEN
C-CLOSED

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TABLE 1

FOR YOUR INFORMATION

	NORMAL CONTROLS				RO OR LOCA	BO OR
	SERIES		PARALLEL		UN 1 UN 2	LOC UNI
	TRAIN A	TRAIN B	TRAIN A	TRAIN B	TR 'A' KEY ON	TR' KEY
CRA-P-1	X		X		X	
CRA-C-1	X	X	X		X	
Note 1 CR-AHU-1☆	X		X		X	
CRA-AHU-1☆	X		X		X	
SGR-AHU-1A☆	X		X		X	
SGR-AHU-2A☆	X		X		X	
SGR-AHU-1C☆	X		X		X	
SGR-AHU-2C☆	X		X		X	
BR-XF-1	X		X		X	
CRA-P-2		X		X		
CRA-C-2	X	X		X		
Note 1 CR-AHU-2☆		X		X		
CRA-AHU-2☆		X		X		
SGR-AHU-1B☆		X		X		
SGR-AHU-2B☆		X		X		
SGR-AHU-1D☆		X		X		
SGR-AHU-2D☆		X		X		
BR-XF-2		X		X		
Note 1 CRA-DAPFT-1	X		X			
Note 1 CRA-DAPFT-2		X		X		

X-Denotes operational equipment
☆-Includes associated dampers

NOTE: 1. These components operate independent of the TRAIN KEY SELECTOR switches. Upon receipt of a LOCA or Blackout all of these components are allowed to operate.

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3/4.7.6 CONTROL AREA VENTILATION SYSTEM

LIMITING CONDITION FOR OPERATION

3.7.6 Two independent Control Area Ventilation Systems shall be OPERABLE.

APPLICABILITY: ALL MODES

ACTION: (Units 1 and 2)

MODES 1, 2, 3 and 4:

With one Control Area Ventilation System inoperable, restore the inoperable system to OPERABLE status within 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

MODES 5 and 6:

a. With one Control Area Ventilation System inoperable, restore the inoperable system to OPERABLE status within 7 days or initiate and maintain operation of the remaining OPERABLE Control Area Ventilation System in the recirculation mode; and

b. With both Control Area Ventilation Systems inoperable, or with the OPERABLE Control Area Ventilation System, required to be in the recirculation mode by ACTION a., not capable of being powered by an OPERABLE emergency power source, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.6 Each Control Area Ventilation System shall be demonstrated OPERABLE:

a. At least once per 12 hours, by verifying that the control room air temperature is less than or equal to 120°F;

b. At least once per 31 days on a STAGGERED TEST BASIS, by initiating, from the control room, flow through the HEPA filters and charcoal adsorbers and verifying that the system operates for at least 10 hours with the heaters operating;

SURVEILLANCE REQUIREMENTS (Continued)

c. At least once per 18 months, or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) following painting, fire or chemical release in any ventilation zone communicating with the system, by:

1) Verifying that the system satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% and uses the test procedure guidance of Regulatory Positions C.5.a, C.5.c, and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, and the system flow rate is 2000 cfm ± 10%;

2) Verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than 1%; and

3) Verifying a system flow rate of 2000 cfm ± 10% during system operation when tested in accordance with ANSI N510-1975.

d. After every 720 hours of charcoal adsorber operation, by verifying within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than 1%;

e. At least once per 18 months, by:

1) Verifying that the pressure drop across the combined pre-filters, HEPA filters and charcoal adsorber banks is less than 5 inches Water Gauge while operating the system at a flow rate of 2000 cfm ± 10%;

2) Verifying that upon actuation of a diesel generator sequencer the system automatically switches into a mode of operation with flow through the HEPA filters and charcoal adsorber banks;

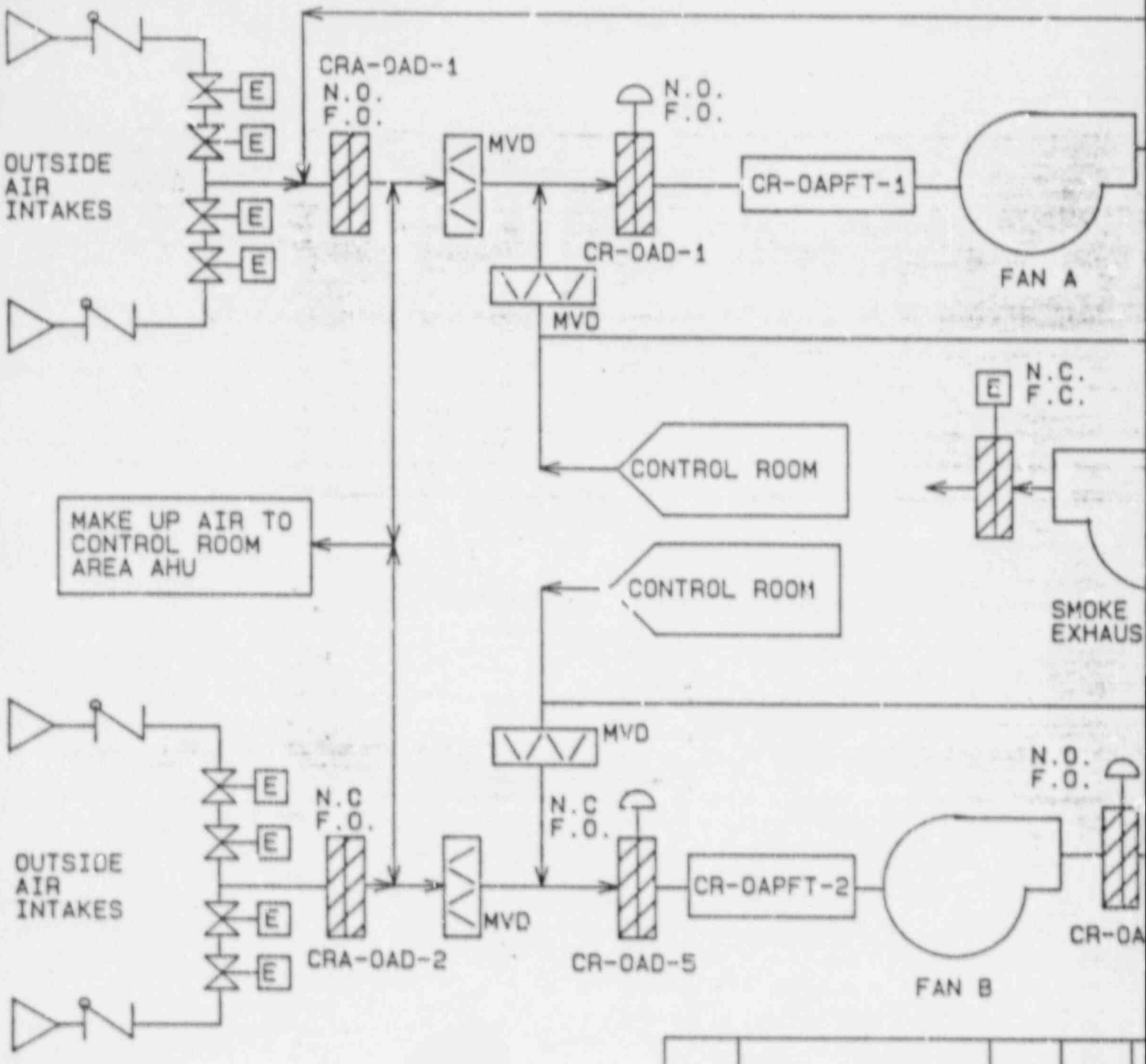
3) Verifying that the system maintains the control room at a positive pressure of greater than or equal to 1/8 inch W.G. relative to the outside atmosphere during system operation; and

4) Verifying that the heaters dissipate 10 ± 1.0 kW when tested in accordance with ANSI N510-1975.

SURVEILLANCE REQUIREMENTS (Continued)

f. After each complete or partial replacement of a HEPA filter bank, by verifying that the HEPA filter bank satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% in accordance with ANSI N510-1975 for a DOP test aerosol while operating the system at a flow rate of 2000 cfm ± 10%; and

g. After each complete or partial replacement of a charcoal adsorber bank, by verifying that the charcoal adsorber satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% in accordance with ANSI N510-1975 for a halogenated hydrocarbon refrigerant test gas while operating the system at a flow rate of 2000 cfm ± 10%.



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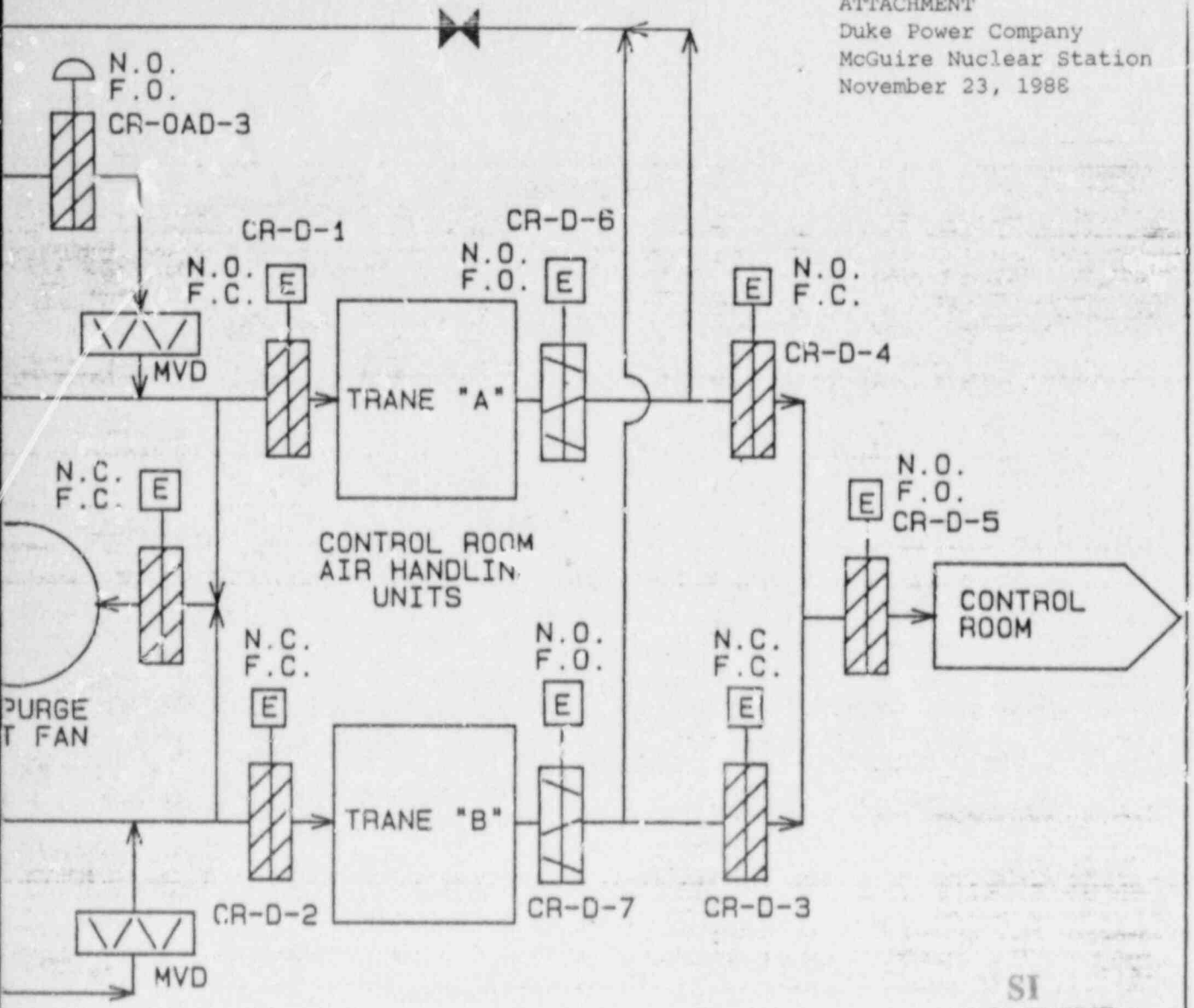

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FIGURE 1

					DUKE POWER COMPANY			
					MCGUIRE NUCLEAR STATION			
					VC SYSTEM-PARTIAL			
					FLOW DIAGRAM			
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		INSPECTED			DESIGNED	DATE		

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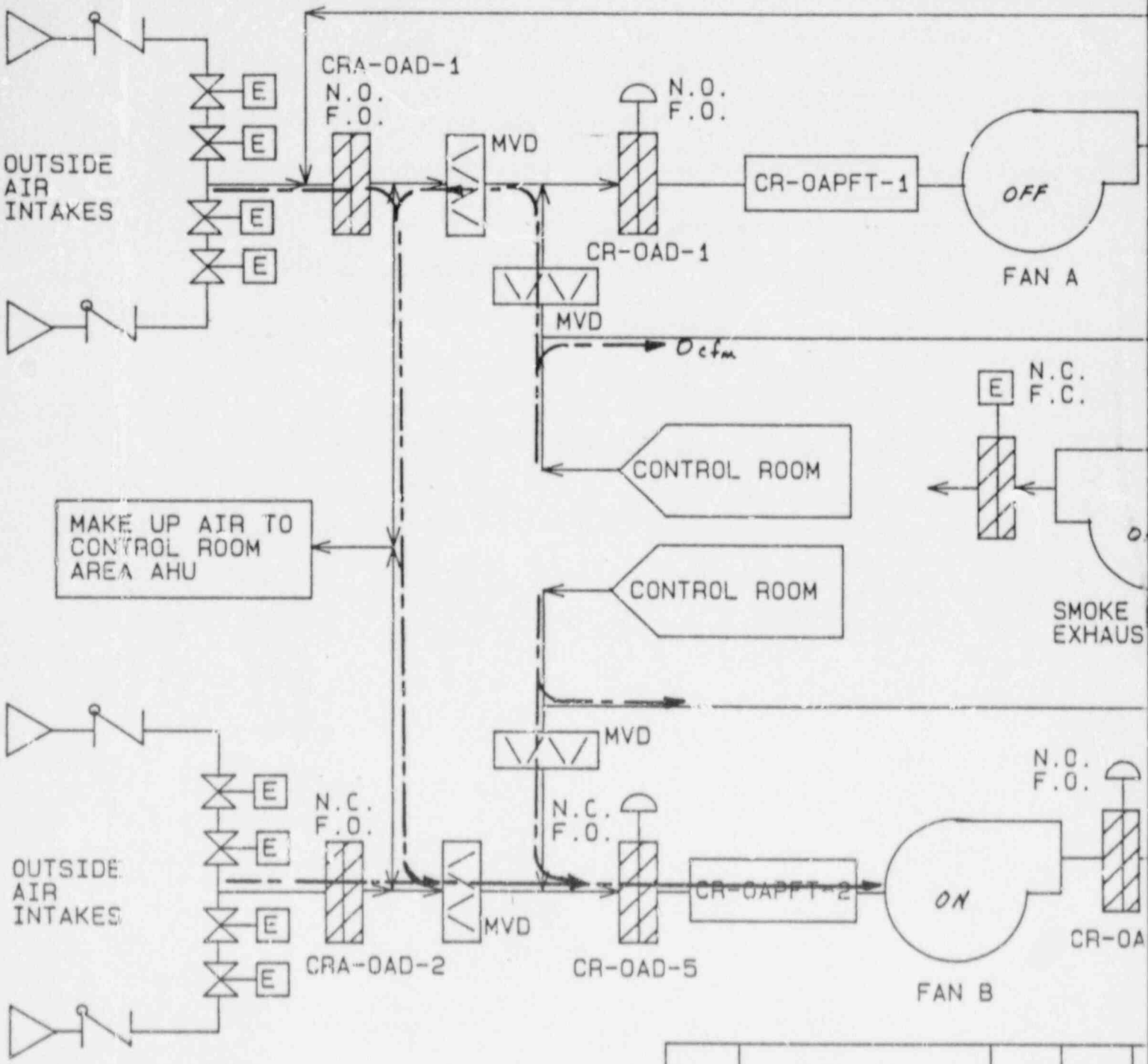

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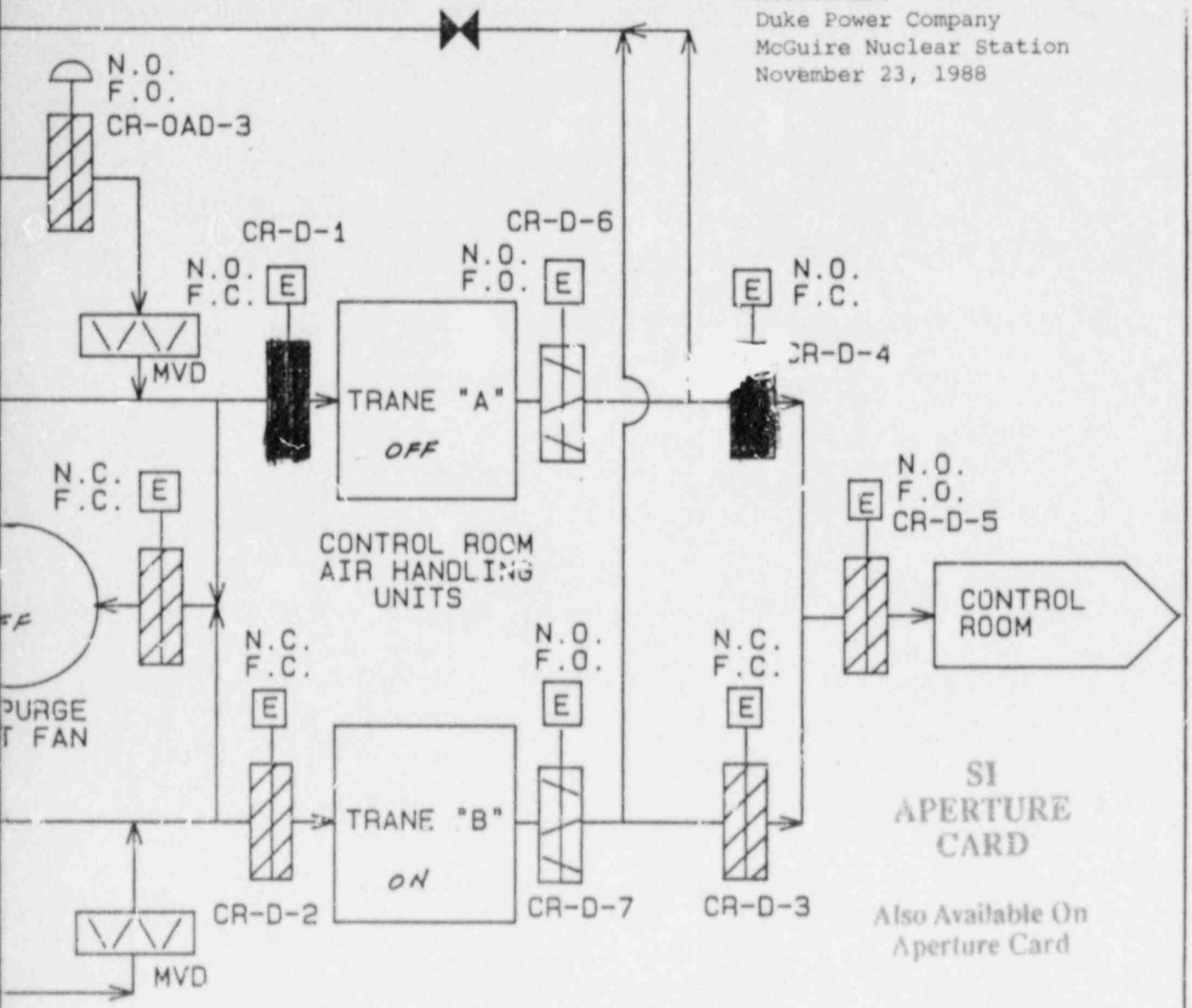

FIGURE 2 - TRAIN "A" POWER FAILURE

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→ Air flow path through filter train this case

					DUKE POWER COMPANY			
					MCGUIRE NUCLEAR STATION			
					VC SYSTEM-PARTIAL			
					FLOW DIAGRAM			
	C	E	M	DRN BY	CHK'D	DWG. NO.	REV	
	INSPECTED			DESIGNER	DATE			

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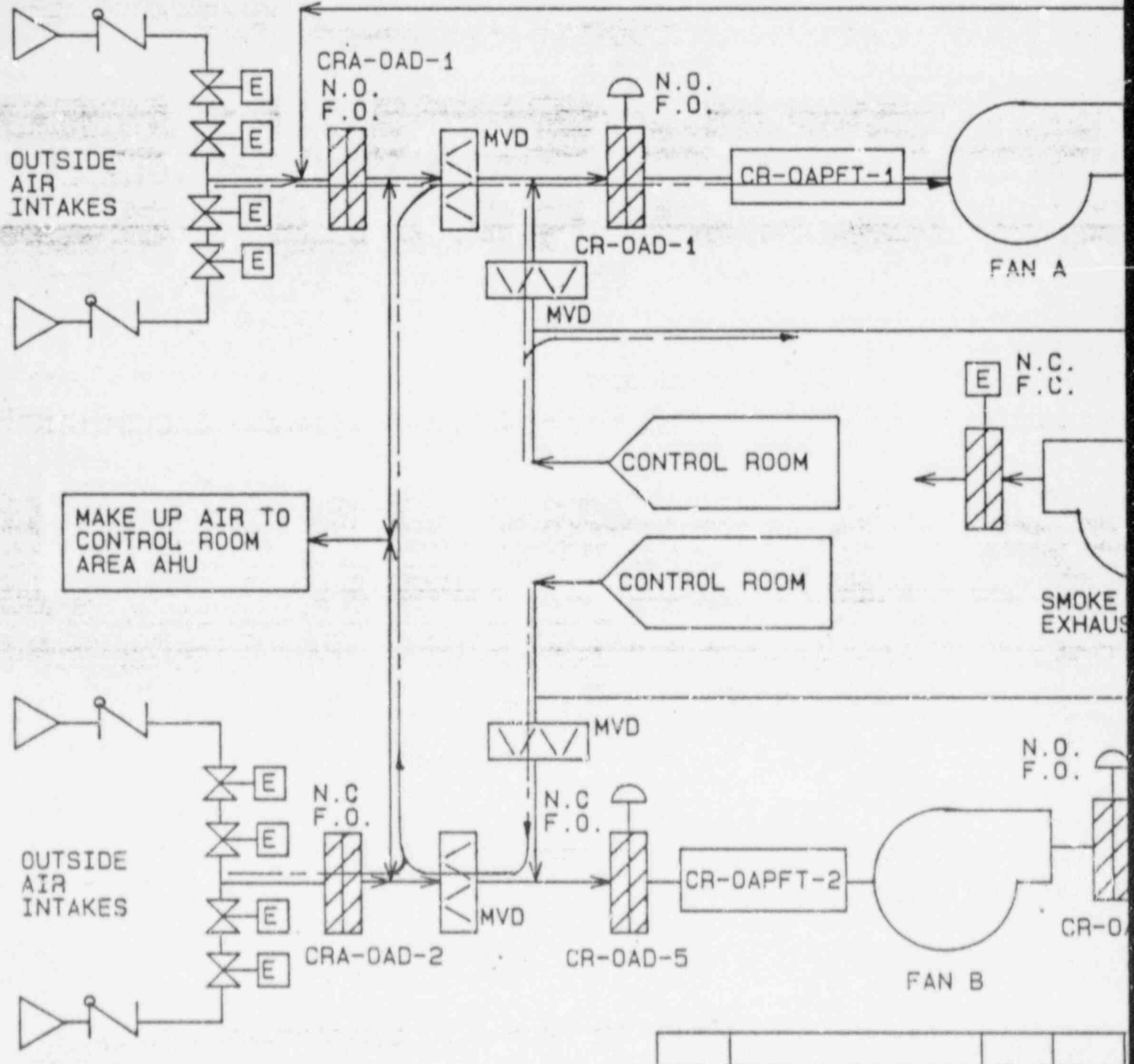

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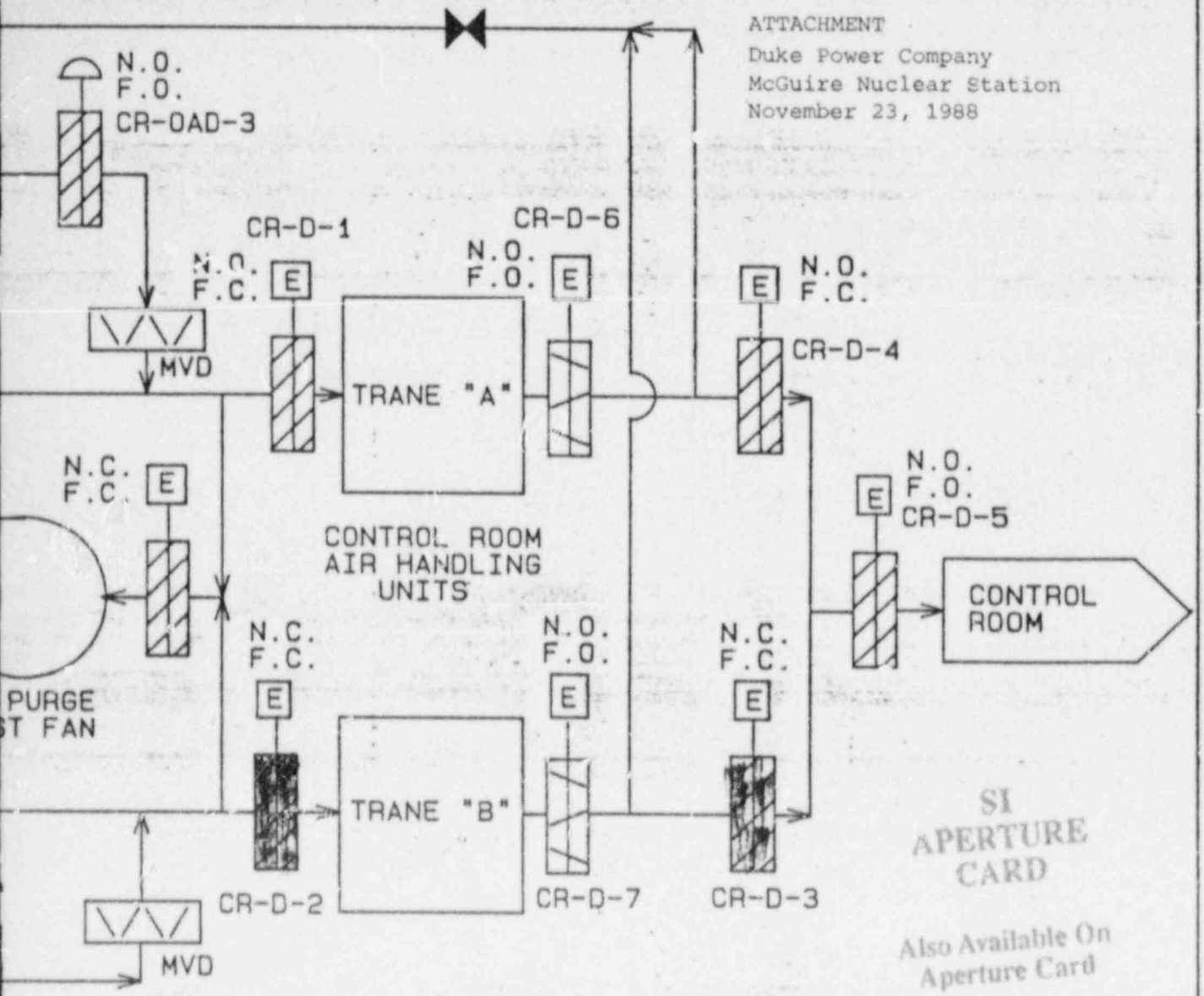

FIGURE 3- TRAIN "B" POWER FAILURE

——— - - ——→ AIR FLOW PATH through filter train this case

					DUKE POWER COMPANY			
					MCGUIRE NUCLEAR STATION			
					VC SYSTEM-PARTIAL			
					FLOW DIAGRAM			
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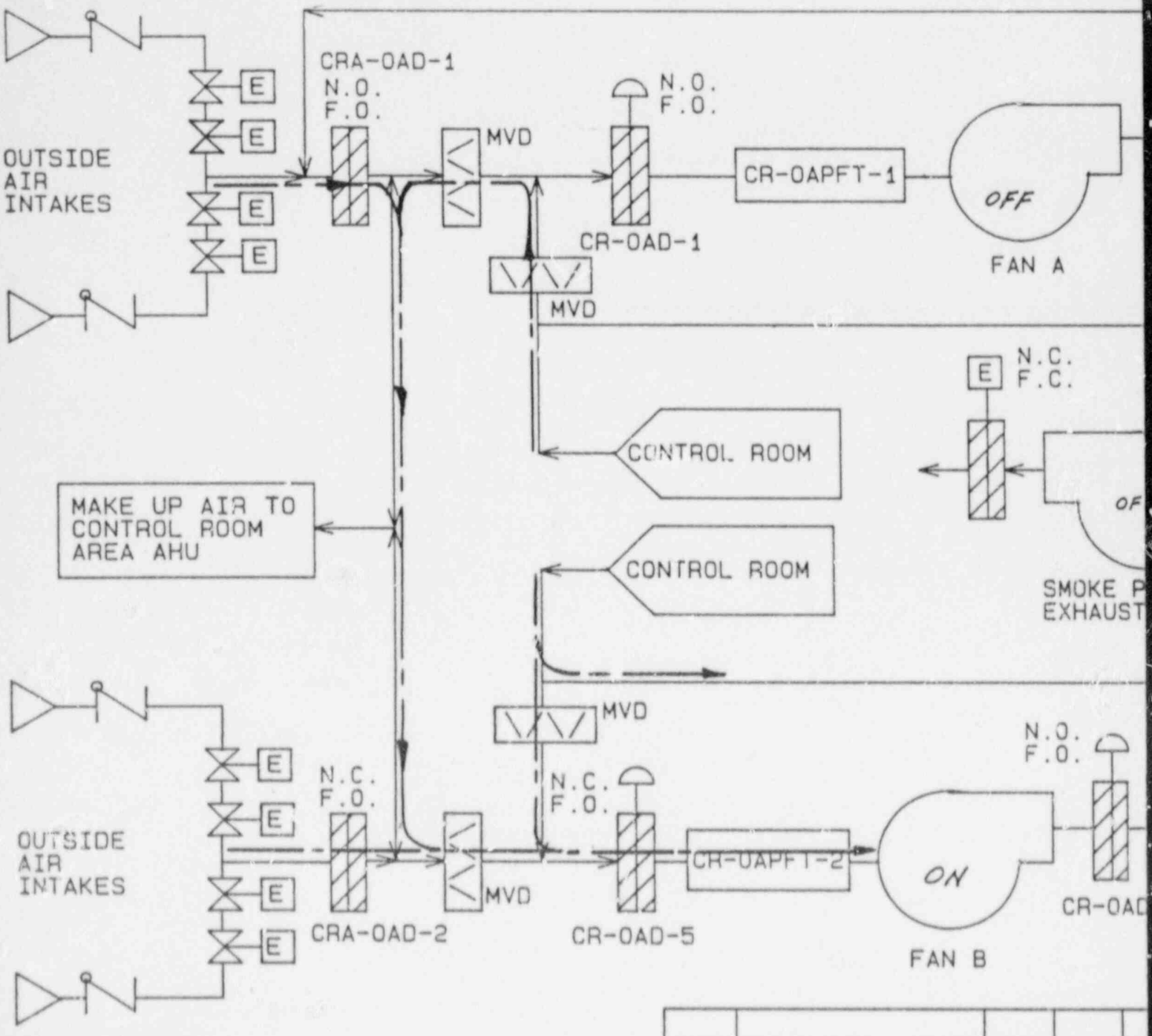

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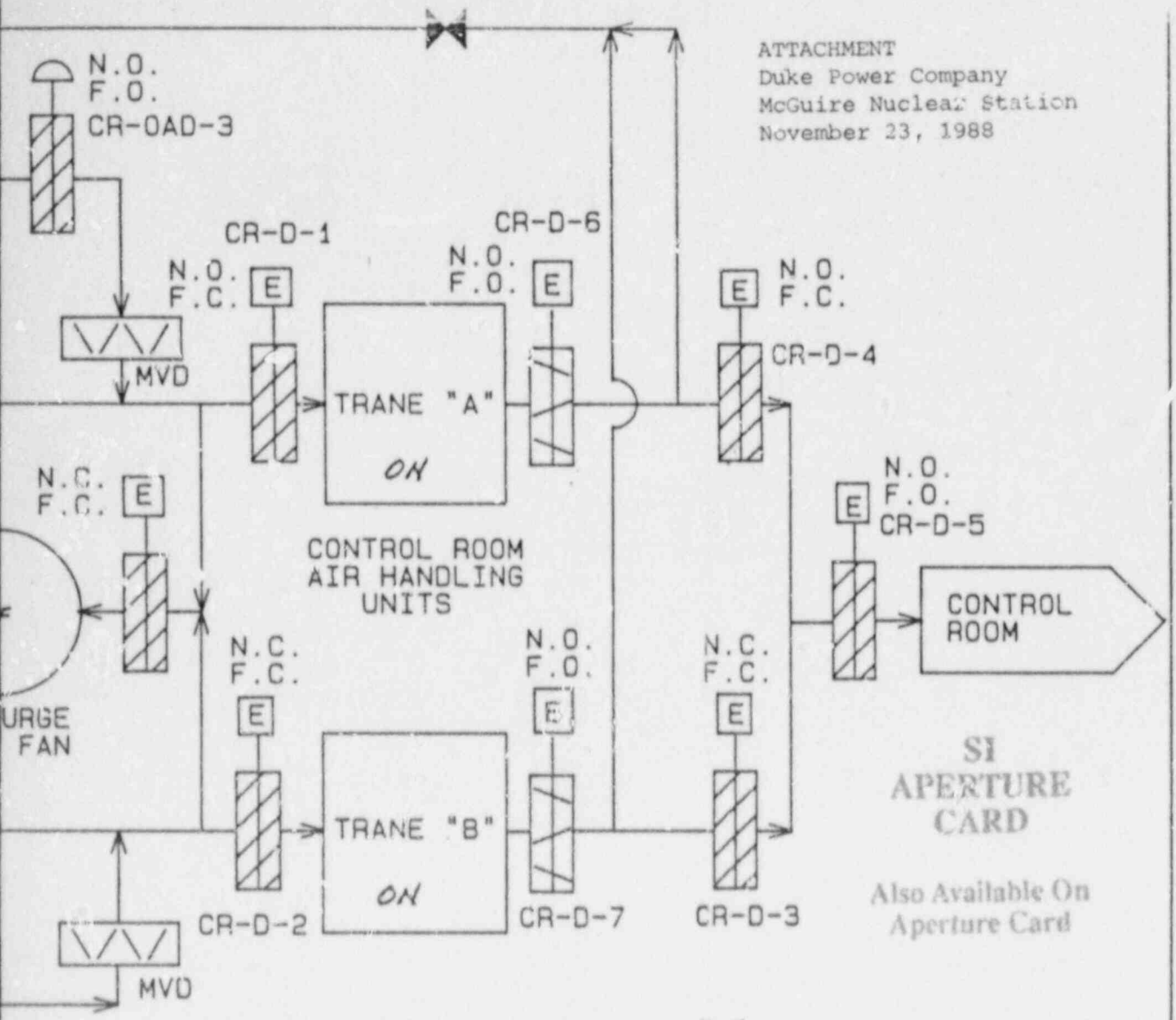

FIGURE 1 - TRAIN "A" MECHANICAL FAN FAILURE

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——— - ——→ Air flow path through filter train this case

					DUKE POWER COMPANY				
					MCGUIRE NUCLEAR STATION				
					VC SYSTEM-PARTIAL				
					FLOW DIAGRAM				
PPR	DATE	C	E	M	DRN BY	CHK'D	DWG. NO.		REV.
		INSPECTED			DESIGNER	DATE			

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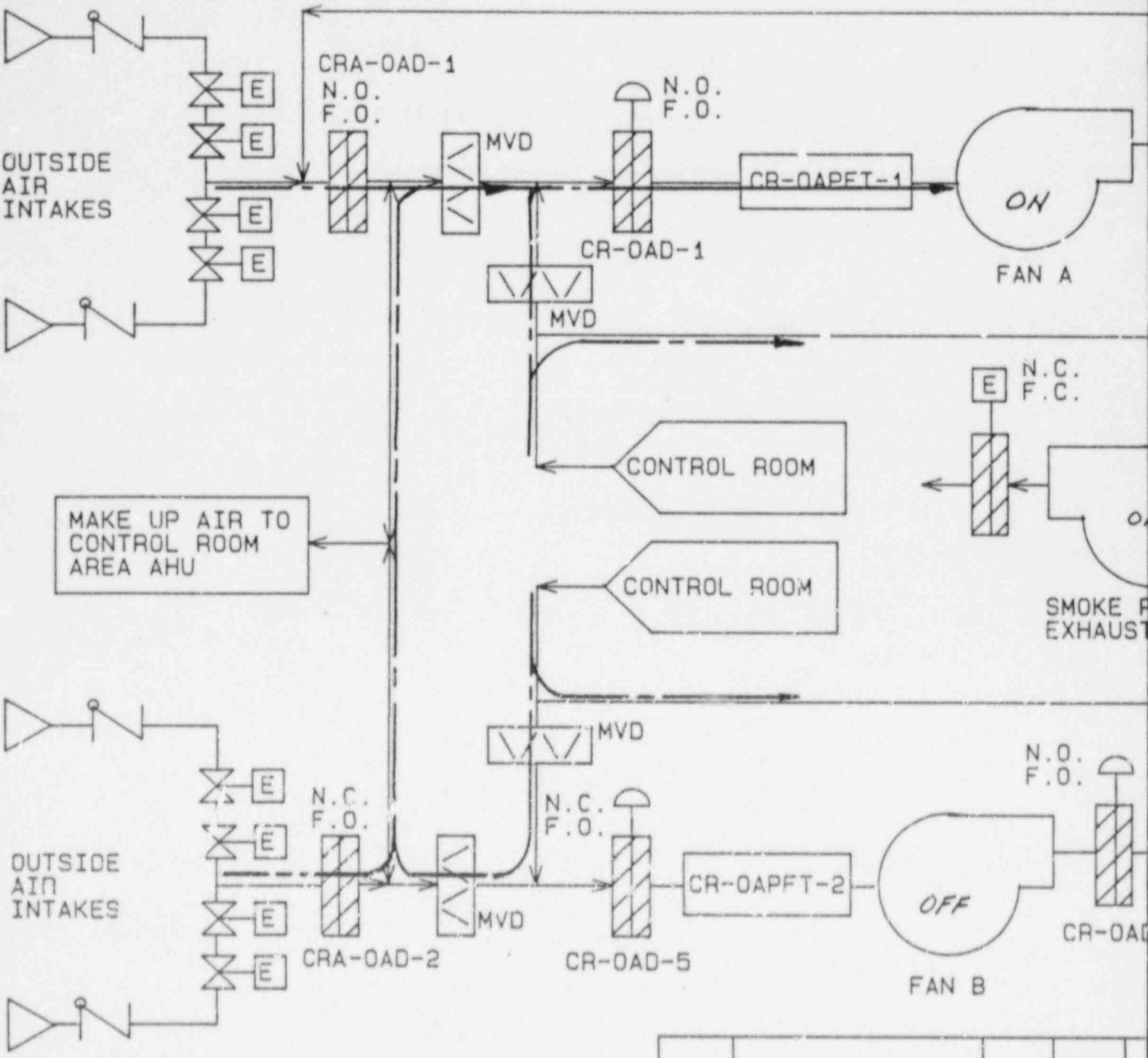


FOR YOUR INFORMATION

NO.	REVISION	CHK	DATE

ATTACHMENT
Duke Power Company
McGuire Nuclear Station
November 23, 1988

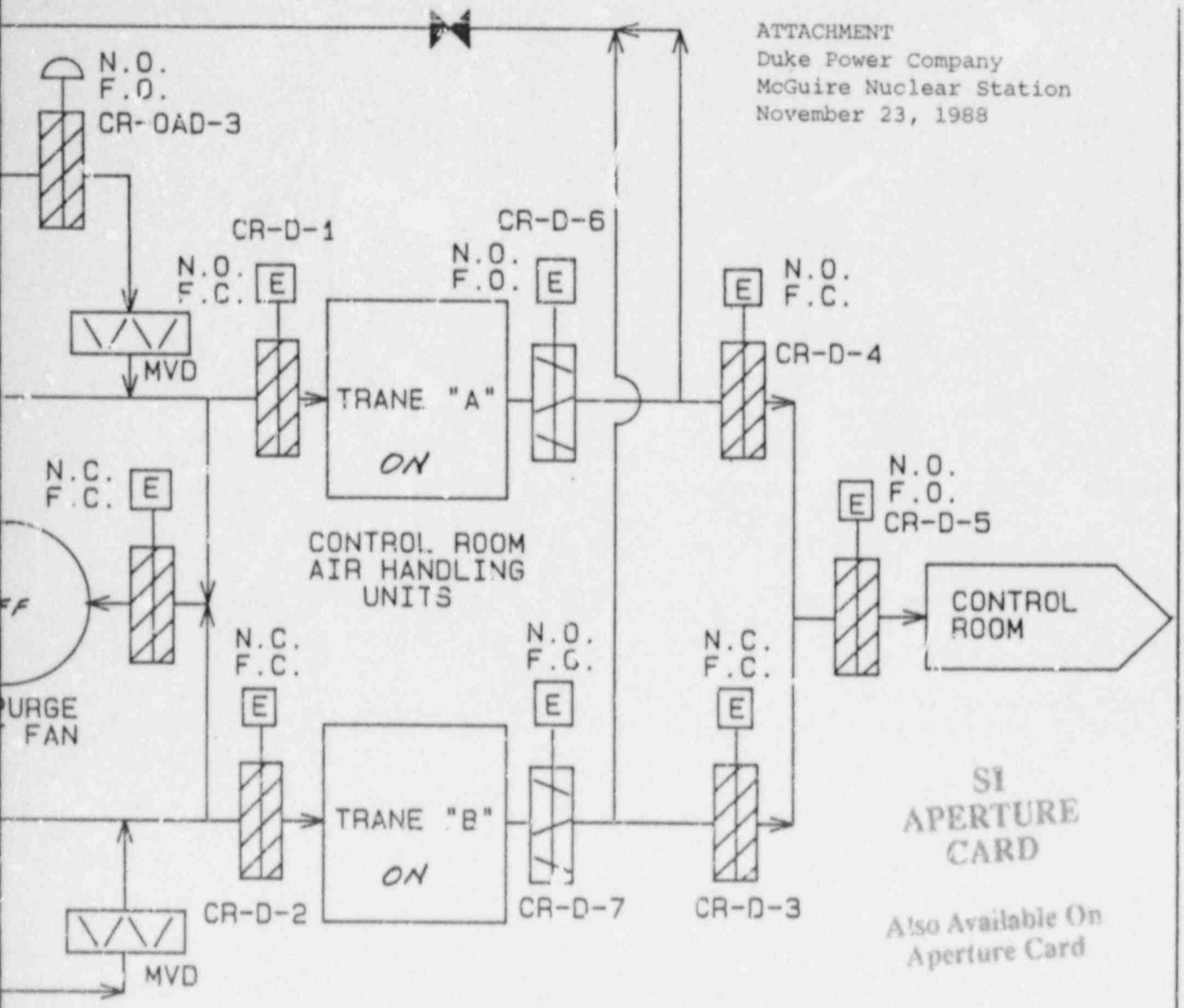
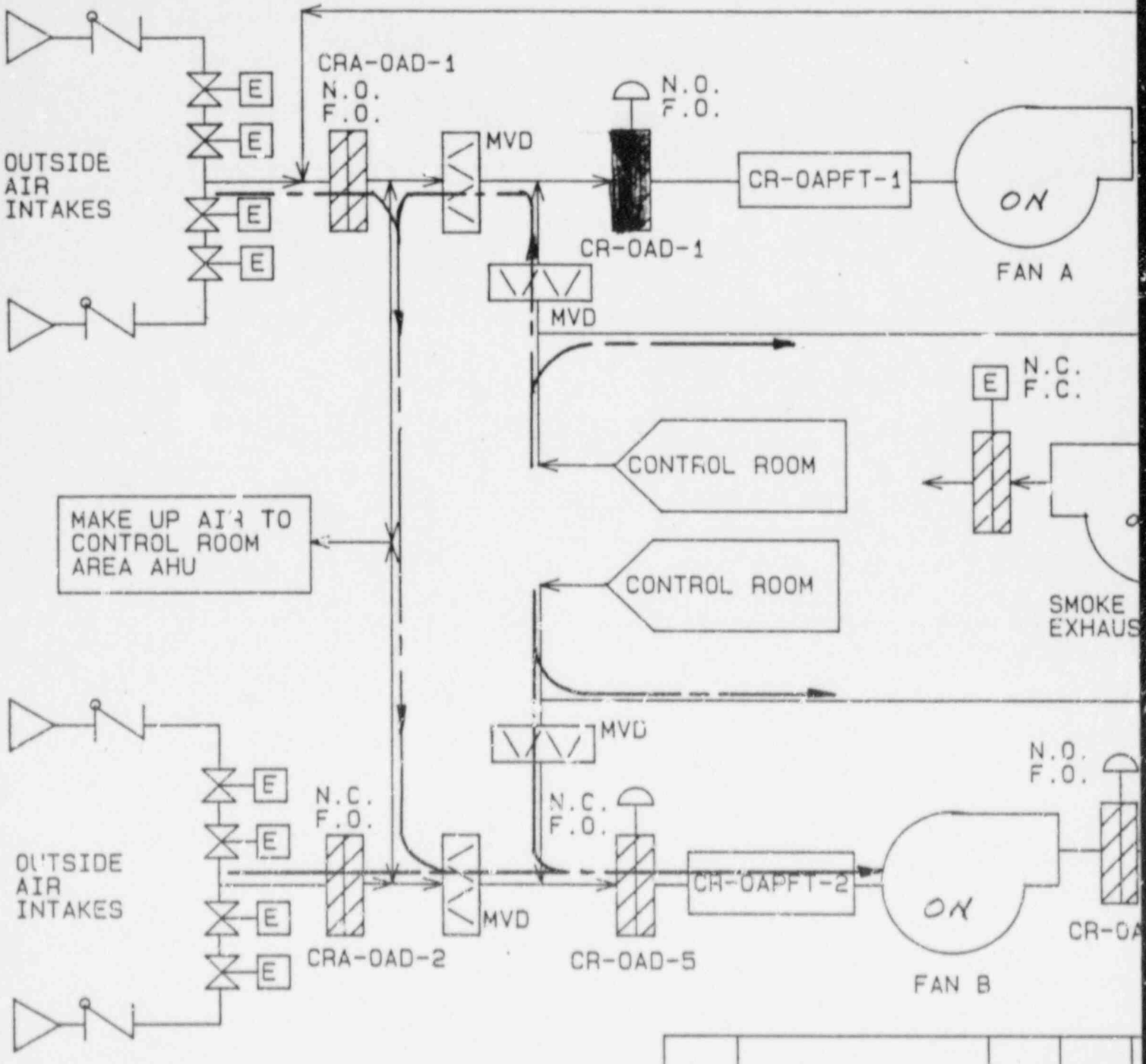


FIGURE 5 - TRAIN "B" MECHANICAL FAN FAILURE

→ Air flow path through filter train this case

					DUKE POWER COMPANY			
					MCGUIRE NUCLEAR STATION			
					VC SYSTEM-PARTIAL			
					FLOW DIAGRAM			
		C	E	M	DRN BY	CHK'D	DWG. NO	REV.
					INSPECTED	DATE		

8811300152-05



FOR YOUR INFORMATION

NO.	REVISION	CHK'D	DATE

ATTACHMENT
Duke Power Company
McGuire Nuclear Station
November 23, 1988

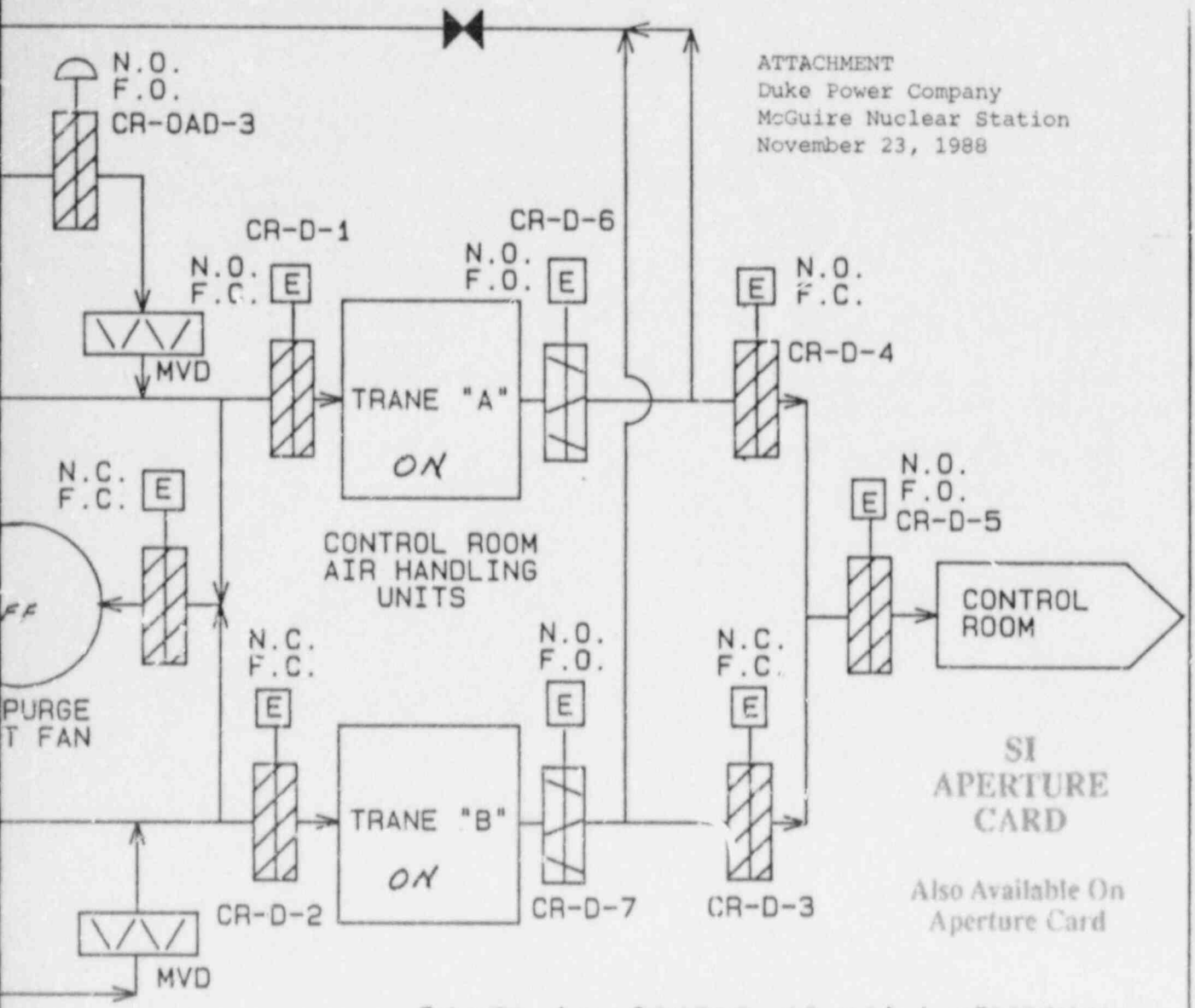


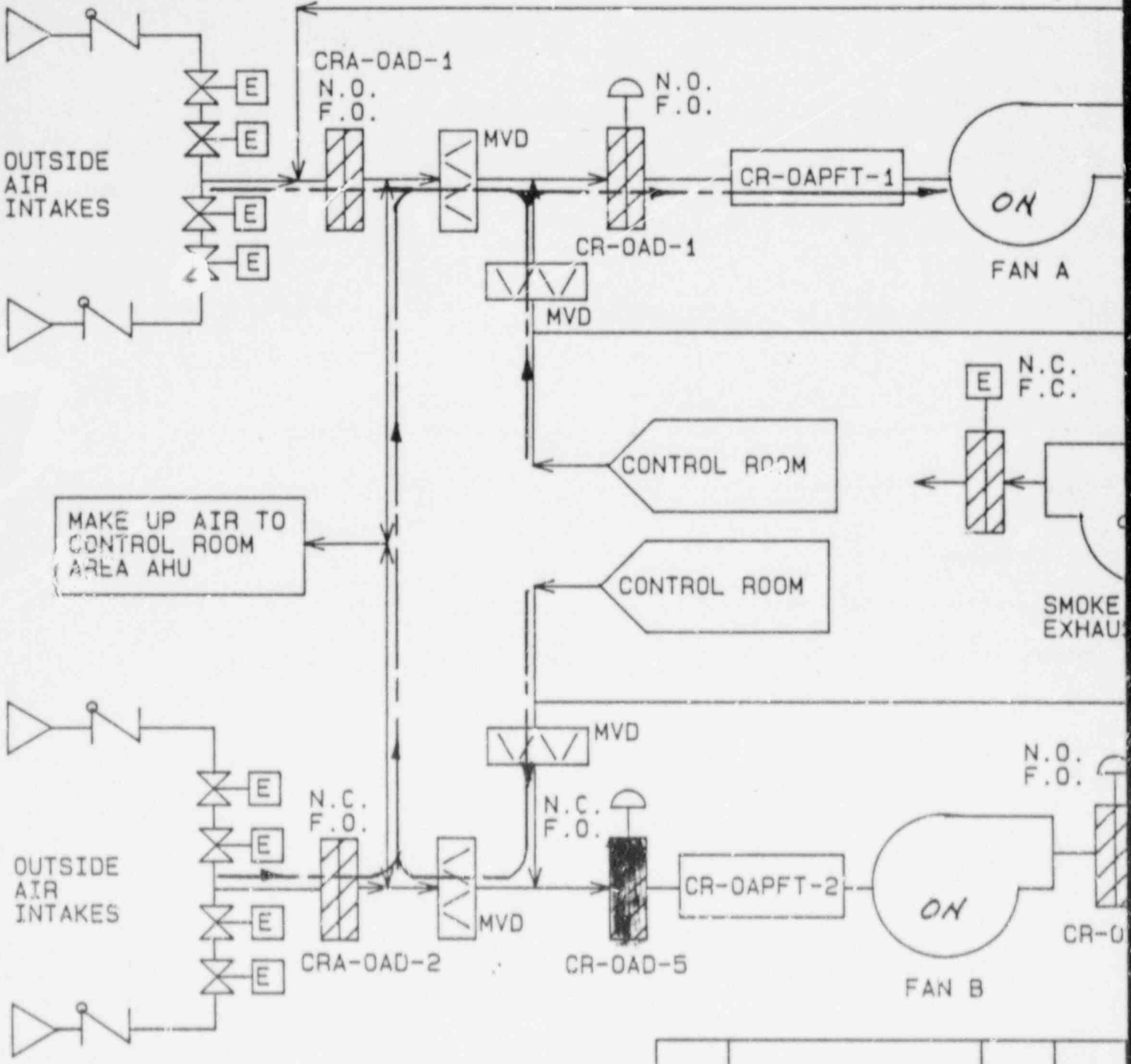
FIGURE 6 - DAMPER CR-OAD-1 MECHANICAL FAILURE CLOSED

D-7

——— Air flow path through filter train this case

					DUKE POWER COMPANY			
					MCGUIRE NUCLEAR STATION			
					VC SYSTEM-PARTIAL			
					FLOW DIAGRAM			
APPD	DATE	C	E	M	DRN BY	CHK'D	DWG. NO.	REV
					INSPECTED	APPROVED		

8811300152-06



FOR YOUR INFORMATION

ATTACHMENT
Duke Power Company
McGuire Nuclear Station
November 23, 1988

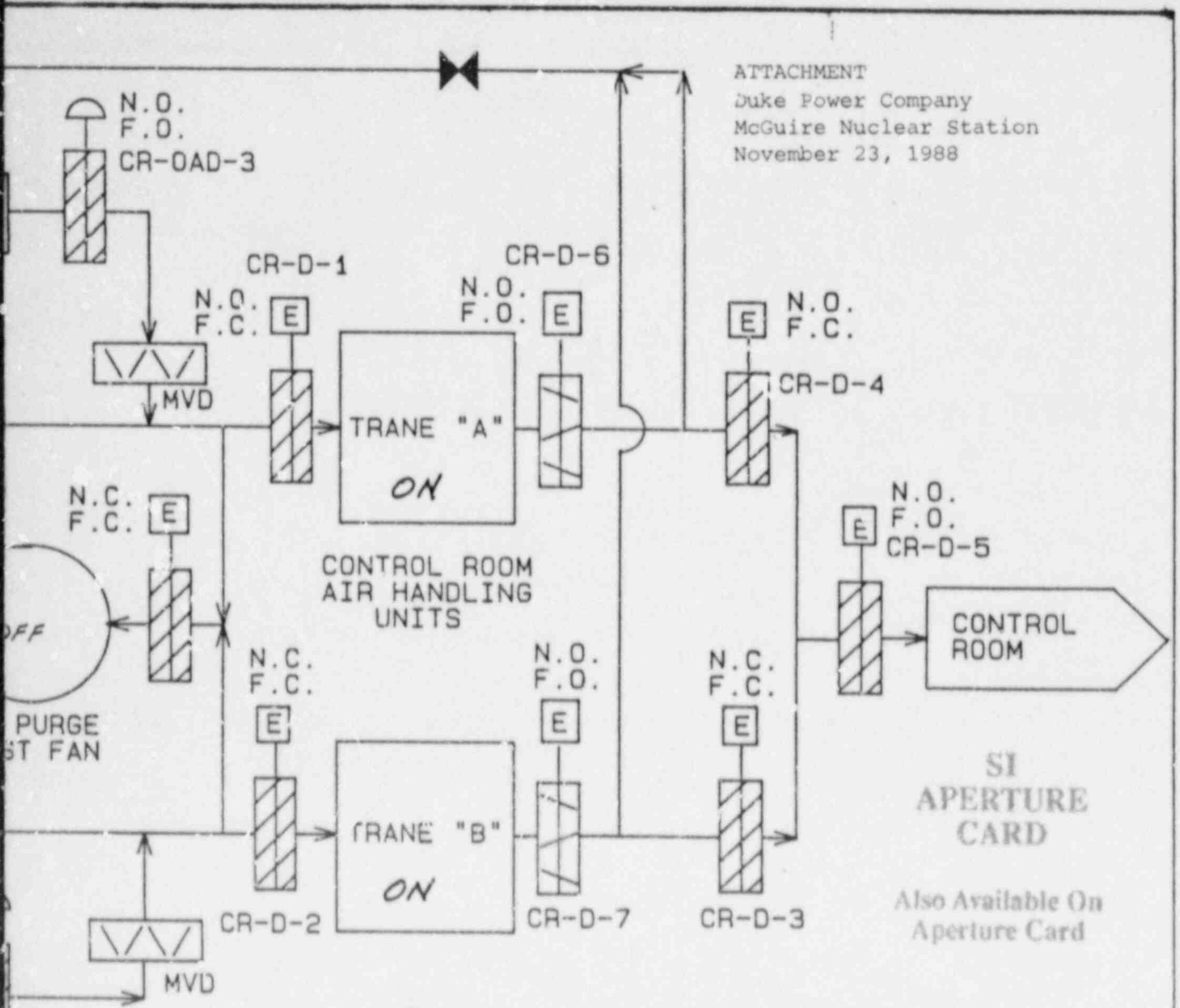


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FIGURE 7 - DAMPER CR-OAD-5 MECHANICAL FAILURE CLOSED

—— - → *Air flow path through filter train this case*

DUKE POWER COMPANY

MCGUIRE NUCLEAR STATION

VC SYSTEM-PARTIAL

FLOW DIAGRAM

APPR DATE	C	E	M	DRN BY	CHK'D	DWG. NO.	REV.

8811300152-07