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October 22, 1990

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U. S. Nuclear Regulatory Commission
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SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report No. 50-313/90-010-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i), 10CFR50.73(a)(2)(ii), and 10CFR50.73(a)(2)(v), attached is the subject report concerning inoperable control room habitability systems due to leakage in air supply system to control room isolation dampers caused by failure to adequately test and maintain system following modification.

Very truly yours,

James J. Fisicaro

James J. Fisicaro
Manager, Licensing

JJF/LAT/sgw
Attachment

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NRC Form 366
(6-89)

U.S. Nuclear Regulatory Commission
Approved OMB No. 3150-0104
Expires: 4/30/92

LICENSEE EVENT REPORT (LER)

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TITLE (4) Inoperable Control Room Habitability Systems Due to Leakage in Air Supply System to Control Room Isolation Dampers Caused by Failure to Adequately Test and Maintain System Following Modification

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)
0 9	2 1	9 0	9 0	-- 0 1 0	-- 0 0	1 0	2 2	9 0	ANO-2	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)							
	N	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)	
POWER LEVEL		20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v)		73.71(c)	
(10)	0 8 0	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		Other (Specify in	
		20.405(a)(1)(iii)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		Abstract below and	
		20.405(a)(1)(iv)	X	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		in Text, NRC Form	
		20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		366A)	

LICENSEE CONTACT FOR THIS LER (12)

Name	Telephone Number Area Code
Larry A. Taylor, Nuclear Safety and Licensing Specialist	5 0 1 9 6 4 - 3 1 0 0

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	

SUPPLEMENT 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 fifteen single-space typewritten lines) (16)

On September 15, 1990, it was determined that four check valves located in the air supply system to two dampers used for isolation of the ANO-1 control room normal ventilation system had not been previously tested. The dampers are pneumatic valves requiring air pressure for inflation. Air supply is provided by the non-safety related instrument air (IA) system and two redundant reserve air accumulators which serve as a backup reservoir of closing air. The check valves function to prevent a loss of accumulator air pressure due to backleakage should the IA system become unavailable. On September 21, 1990, testing of the air supply system revealed several areas of degraded system integrity including check valve leakage. Immediate corrective actions included repairs of leakage at piping joints and threaded connections. The check valves were replaced and the system was modified by adding a manual isolation valves in each line to provide isolation of the accumulators from the IA system. Procedure changes were implemented requiring maintaining the manual valves in a closed position except for periodic cycling for recharging the accumulators. A procedure will be developed and testing of the dampers and air supply system will be performed quarterly to monitor system integrity. Additionally, an evaluation of the overall system design is being performed. The root cause of this condition was determined to be an inadequate design change process that was in place in 1978 when the system was modified to its current configuration.

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A. Plant Status

At the time of discovery of this condition Arkansas Nuclear One, Unit One (ANO-1) was operating at approximately 80 percent of rated thermal power. Arkansas Nuclear One, Unit Two (ANO-2) was operating in Mode 1 (Power Operation) at 100 percent of rated thermal power.

B. Event Description

The ANO-1 and ANO-2 control rooms are located adjacent to each other and are separated by a wall containing louvered openings to provide for air flow between the rooms. The two rooms form a common control room envelope [NA] which is provided with systems designed to ensure habitability of the envelope during normal plant operation and following a postulated accident on either unit(see Figure 1). The habitability systems include:

- A separate normal heating, ventilation and air conditioning (HVAC) system for each control room.
- An isolation system for each control room's normal HVAC system which provides automatic isolation of these systems by initiating closure of dampers located in the normal HVAC systems supply and exhaust ductwork. Associated instrumentation systems for the isolation system include toxic gas (chlorine) monitors, radiation monitors and smoke detectors.
- An emergency ventilation system (CREVS) [VI] consisting of redundant trains of equipment (e.g., fans, filters, etc.) for recirculation and filtration of the control room envelope air volume following isolation of the normal HVAC system. The CREVS also provides for pressurization of the control room envelope to prevent ingress of unfiltered outside air.
- An emergency air conditioning system (CREACS) [VI] consisting of redundant trains of equipment (e.g., fans, compressors, etc.) to provide cooling of the control room envelope under isolated conditions.

In September 1990, during the course of an NRC inspection, an inspector requested information related to previous leak testing of four (4) check valves in the air supply piping to the two (2) isolation dampers (CV-7905 and CV-7907) [DMP] located in the normal HVAC system supply and exhaust ductwork for the ANO-1 control room (see Figure 2). The isolation dampers are normally open, pneumatic valves (bladder type valves) requiring air pressure for inflation to provide isolation of the normal HVAC system. Air supply to the dampers is normally provided by the plant's non-safety related instrument air (IA) [LD] system. The air supply system also incorporates the use of two redundant

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reserve air accumulators (VRA-2A and VRA-2B) [RVR] which serve to provide a backup reservoir of closing air for actuating and/or maintaining the dampers in a closed position following a postulated loss of instrument air system. The check valves in the air supply piping upstream of the accumulators provide isolation of the accumulators to ensure this air source is not depleted due to depressurization of the instrument air system.

An investigation was conducted by System Engineering personnel to determine if previous testing of the check valves had been performed. On September 15, 1990, it was concluded that testing of the check valves had not been conducted. The results of previous surveillance testing indicated that the capability to close the dampers and isolate the ANO-1 control room within 10 seconds as required by the Technical Specifications could be achieved; however, the capability of the check valves to prevent a loss of accumulator or system air pressure due to backleakage to a depressurized instrument air system which could result in the damper reopening was unknown at this time.

Following discovery that the check valves had not been tested, a comprehensive action plan was developed and implemented to address this finding. A special work plan was developed to perform testing to verify the integrity of the check valves and included provisions for checking the leak tightness of each control room isolation damper, both accumulators and other components of the air supply system to the dampers (e.g., soldered piping joints, threaded fittings, solenoid valves, etc.). On September 21, 1990, performance of part of the work plan revealed several areas of degraded system integrity including check valve leakage. Based on this information the dampers and the ANO-1 control room isolation system were declared to be inoperable. As a compensatory measure the work plan developed for testing the system had required the closing and sealing of fire dampers located in the ANO-1 control room normal HVAC system and securing the normal HVAC system supply fans as prerequisites to performance of the testing. Therefore, at the time of discovery of the excessive system leakage, the control room envelope was adequately isolated. Additional actions were initiated to restore the system integrity to an acceptable condition. On September 27, 1990, the dampers and isolation system were determined to be operable and the control room HVAC system was returned to a normal alignment.

C. Root Cause

A detailed review of the original design and subsequent modifications of the ANO-1 control room isolation system since initial plant construction was performed. This review revealed that in 1978 a modification was performed which established the current system configuration using check valves between the

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non-safety related IA system and the reserve air accumulators. A review of the documentation related to this modification revealed that testing of the functional capability of the check valves to prevent backleakage to a depressurized IA system and testing to verify the integrity, (i.e., leak tightness) of other components of the system was not specified as being required and therefore was not performed prior to placing the modified system in service. Additionally, this oversight subsequently resulted in the failure to implement provisions requiring periodic leak testing of the check valves and other portions of the isolation system to verify system integrity did not degrade over time.

Based on this information, the root cause of this event was determined to be deficiencies related to requirements for post modification testing in the design change process in place when the system was modified in 1978.

In August 1988, the NRC issued Generic Letter (GL) 88-14, Instrument Air Supply System Problems Affecting Safety-Related Equipment, to all holders of operating licenses for nuclear power reactors. GL 88-14, indicated that as a result of NRC studies of problems associated with instrument air (IA) systems for a number of years, concerns were identified related to adverse effects on safety-related equipment caused by IA system failures. These concerns included indications that the performance of air-operated, safety-related components may not be in accordance with their intended safety function because of inadequacies in the design, installation and maintenance of the IA system. GL 88-14 required licensees to verify that the design of the entire IA system; including air or other pneumatic accumulators was in accordance with its intended function; including verification by test that air-operated, safety-related components would perform as expected in accordance with all design basis events; including a loss of normal instrument air.

Reviews and evaluations of the ANO-1 IA system and air operated component designs and the functional testing required by GL 88-14 should have identified the deficiencies associated with the air supply system to the ANO-1 control room isolation dampers discussed in this report. Evaluations conducted by ANO in response to GL 88-14 identified this system as being within the scope of GL 88-14. However, it was inappropriately concluded that current surveillance testing of the system was adequate even though this testing did not include simulating a loss of the IA system and ensuring the dampers would close and remain closed for an acceptable period of time. Based on this information it was concluded that a contributing factor to the duration of this condition was inadequate actions taken by ANO in response to GL 88-14.

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D. Corrective Actions

Following discovery on September 21, 1990, that the check valves and other components of the system leaked excessively immediate corrective actions included repair of piping joints, threaded connections and solenoid valve leakage. The four check valves were removed and replaced with new valves. However, due to the unavailability of a better designed valve, it was necessary to utilize check valves with a similar design. Bench testing of the new valves for leakage prior to installation indicated that due to their design, i.e., bronze seats and disc, little improvement in minimizing leakage was obtained by this replacement. In order to resolve this problem, the system was modified by adding a manual isolation valve in each line directly upstream of the check valves. By maintaining the manual valves in a closed position, positive isolation of each accumulator from the IA system could be achieved. Results of system leak testing with the manual valves closed indicated leakage was significantly reduced. Conservative calculations based on final leakage rates in this configuration indicated the isolation dampers could be closed and maintained in a closed position for a minimum time period of approximately 72 hours under worst case conditions. Routine recharging of the accumulators from the IA system can be accomplished by periodically cycling the manual valves. Appropriate procedures changes were completed requiring maintaining the manual valves normally closed and opening them periodically for recharging of the accumulators. Remote monitoring of air supply system pressure is provided by pressure switches which initiate a control room annunciator alarm if system pressure decreases to approximately 50 psig.

Additionally, procedure changes were implemented to require closing and sealing of the fire dampers located in the ANO-1 CR normal HVAC system supply and exhaust ductwork within 8 hours should a loss of IA occur for any reason. This action will ensure adequate ANO-1 control room isolation is achieved and can be maintained for an indefinite period of time following postulated events.

Long term corrective actions include:

- Development of a permanent plant procedure and performance of periodic testing of the isolation dampers and air supply system to monitor system integrity. Testing will initially be performed on a quarterly basis and the data obtained will be evaluated to determine if corrective actions are necessary. Additionally, changes in the frequency of test performance may be made based on the test results. The procedure will be developed and testing initiated by 12/31/90.

- Evaluation of an alternate system design including consideration of replacement of the existing isolation dampers with fail safe (i.e., fail closed) components or modifications to enhance the current system design. This evaluation will be completed by 3/1/91.

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The process used to develop and implement plant modifications at ANO has changed significantly since occurrence of the errors which led to this event. Improvements have been made in areas such as design change package development including more detailed reviews of design basis requirements for plant systems and components and incorporation of testing requirements which are consistent with the design basis to ensure functional capabilities are verified prior to placing modified systems in service. In 1987, ANO revised the existing 10CFR50.59 program with the objective of improving the quality, depth and documentation of reviews conducted per the requirements of 10CFR50.59 for plant design changes and procedure changes. This program requires detailed reviews of design basis documents for each design change. Additionally, ANO has initiated a Design Configuration Documentation (DCD) Project intended to develop accurate and accessible documentation related to the design bases for ANO systems. Collectively, these factors should prevent the recurrence of a condition of this type.

With respect to the failure to identify this problem as part of the system evaluations and testing performed in response to GL 88-14, a detailed review and investigation was conducted of the actions taken by ANO following receipt of the Generic Letter. This review indicated several weaknesses in the process used to respond to the requirements of GL 88-14 (See Section G, Additional Information).

E. Safety Significance

The potential safety concern of this event is related to the possible degradation of the capability to isolate and and maintain isolation of the ANO-1 portion of the control room envelope from outside environmental conditions during and following occurrence of postulated design basis events (DBEs). The primary DBEs of concern are 1) a loss of coolant accident (LOCA) which could produce external airborne radioactivity which could enter the control room envelope resulting in excessive radiation exposures to individuals occupying the space or 2) a significant toxic gas (e.g., chlorine) release or smoke which could enter the area and may cause incapacitation of personnel or force evacuation of one or both control rooms.

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Conservative calculations utilizing data obtained during initial testing of the system indicate that in the as-found condition, the air supply system was capable of closing and maintaining the ANO-1 control room isolation dampers in a closed condition for a minimum of at least 62 minutes following a postulated rupture or unavailability of the IA system. The instrumentation systems (radiation detectors and chlorine detectors) required to provide actuation signals for initiation of automatic isolation were not affected by this event. Based on this information it was concluded that effective isolation of the control room envelope could have been achieved for any of the initiating events discussed above even considering a concurrent loss of IA.

Considering this, the primary concern relates to the potential for the dampers to reopen after closure as supply air pressure to the dampers decayed due to system leakage. Data obtained during system testing indicated that damper deflation or partial opening would occur once accumulator pressure was reduced to approximately 6 psig. The damper air supply system is equipped with pressure switches which monitor accumulator air pressure and provide a control room annunciator alarm if system pressure is reduced to approximately 50 psig.

Under normal plant conditions actuation of this alarm would have alerted control room personnel to a problem with the isolation system. However, considering that this condition could have existed within a few hours following occurrence of a significant event such as a LOCA, with a loss of IA, recognition and diagnosis of the problem could have been extremely difficult. Additionally, under these conditions it is unlikely that sufficient actions could have been taken prior to actual opening of the dampers.

Subsequent opening of the dampers could have degraded the capability of the control room emergency ventilation filtration system to perform its function of minimizing air leakage into the control room envelope following a postulated accident. The safety analysis calculation used to evaluate cumulative post accident radiation exposures to personnel located in the control rooms assumes that air leakage is minimized by operation of the CREVS. Therefore, this condition could have resulted in invalidating the results of the safety analysis related to this event. The actual safety significance of this is minimized by several factors including; 1) the safety analysis calculation for post accident control room operator doses contains several conservative assumptions (e.g., radiation source terms, length of time personnel are exposed to airborne radioactivity, etc.) which result in postulated personnel exposures greater than those actually expected to occur, 2) considering measures currently in place at ANO to respond to a severe accident or transient (e.g., Emergency Response Organization, procedures, etc.), it is reasonable to believe that if opening of the isolations dampers would have caused excessive radiation levels in the control rooms, these conditions would have been identified and corrective actions taken to isolate the control room within a short time period.

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F. Basis for Reportability

The discovery of excessive leakage in the air supply system to the ANO-1 control room isolation dampers was evaluated and it was concluded that the condition had resulted in previous operation outside the design basis of the plant and was reportable per 10CFR50.72(b)(1)(ii)(B) and 10CFR50.73(a)(2)(ii)(B).

The condition was also considered to be reportable per 10CFR50.72(b)(2)(iii), and 10CFR50.73(a)(2)(v) as a condition that alone could have prevented the fulfillment of the safety function of a system needed to maintain the reactor in a safe shutdown condition and mitigate the consequences of an accident in that the safety function of the control room envelope emergency ventilation filtration system could not be assured following the loss of capability to maintain the ANO-1 control isolation dampers in a closed position following an accident.

These findings were reported to the NRC at 1314 hours on September 21, 1990.

Additionally, since the operability of the CREVS could not be assured and it was determined that this condition had most likely existed for a significant time period beyond that allowed by the Technical Specifications specifying operability requirements and actions for degraded conditions of this system, it was concluded that both units at ANO had operated in a condition prohibited by their applicable Technical Specifications and this event is therefore reportable per 10CFR50.73(a)(2)(i)(B).

G. Additional Information

There have been no similar events reported at ANO.

By letter dated September 18, 1990 (ØCANØ99Ø11), ANO notifi r Region IV of the NRC of a potential discrepancy related to the accuracy the information contained in the ANO response to GL 88-14. A follow-up let er dated September 24, 1990 (ØCANØ99Ø12) provided the results of a preliminary review of ANO's response to GL 88-14 which confirmed that portions of the response were not completely accurate and provided a commitment to perform a detailed reevaluation of GL 88-14 and an assessment to determine the root cause of the inaccurate information. The results of these actions will be provided in accordance with the commitments made in the referenced letters.

Entergy Industry Identification System (EIIS) codes are identified in the text as [XX].

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FIGURE 1

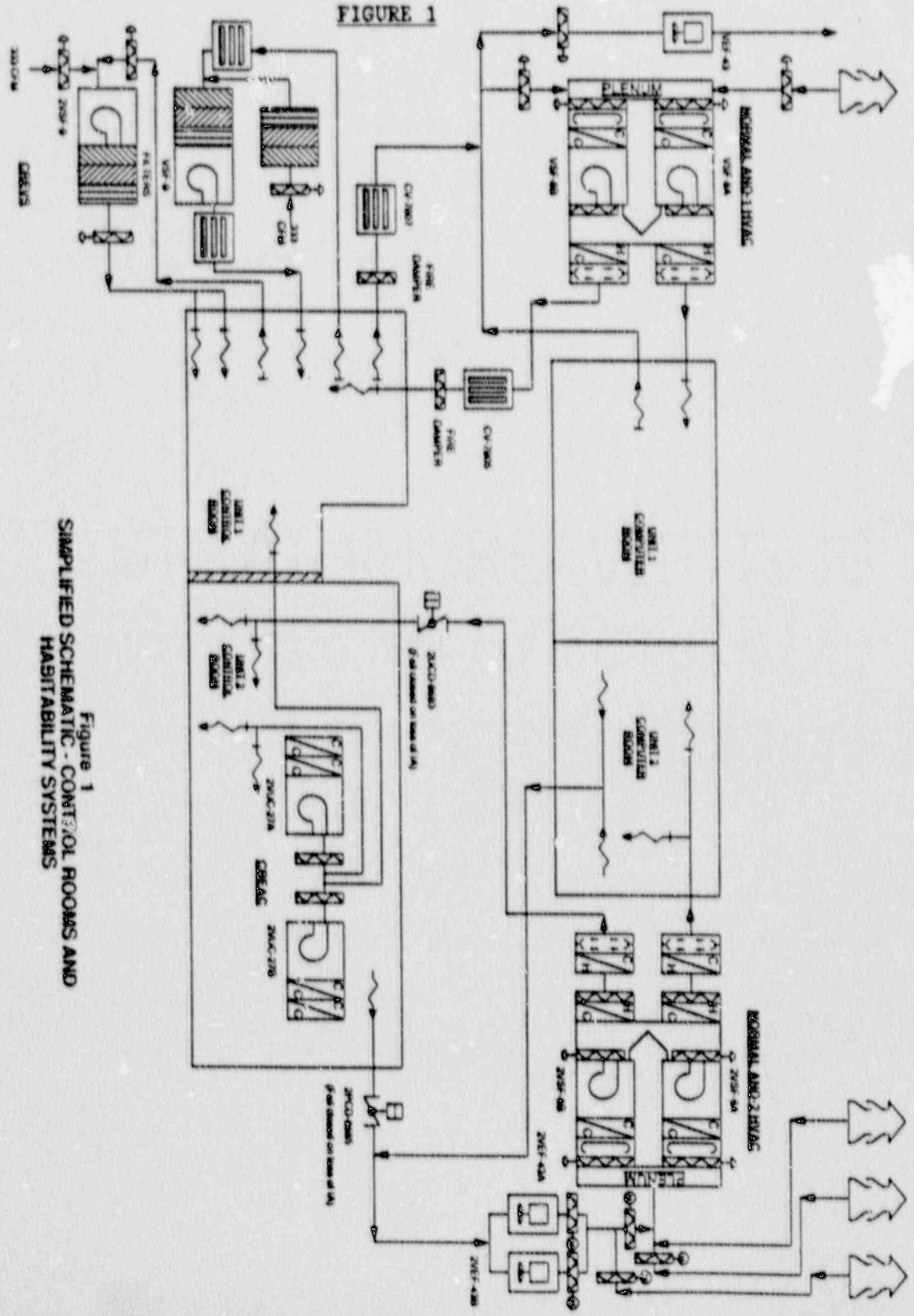

Figure 1
SIMPLIFIED SCHEMATIC - CONTROL ROOMS AND
HABITABILITY SYSTEMS

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FIGURE 2

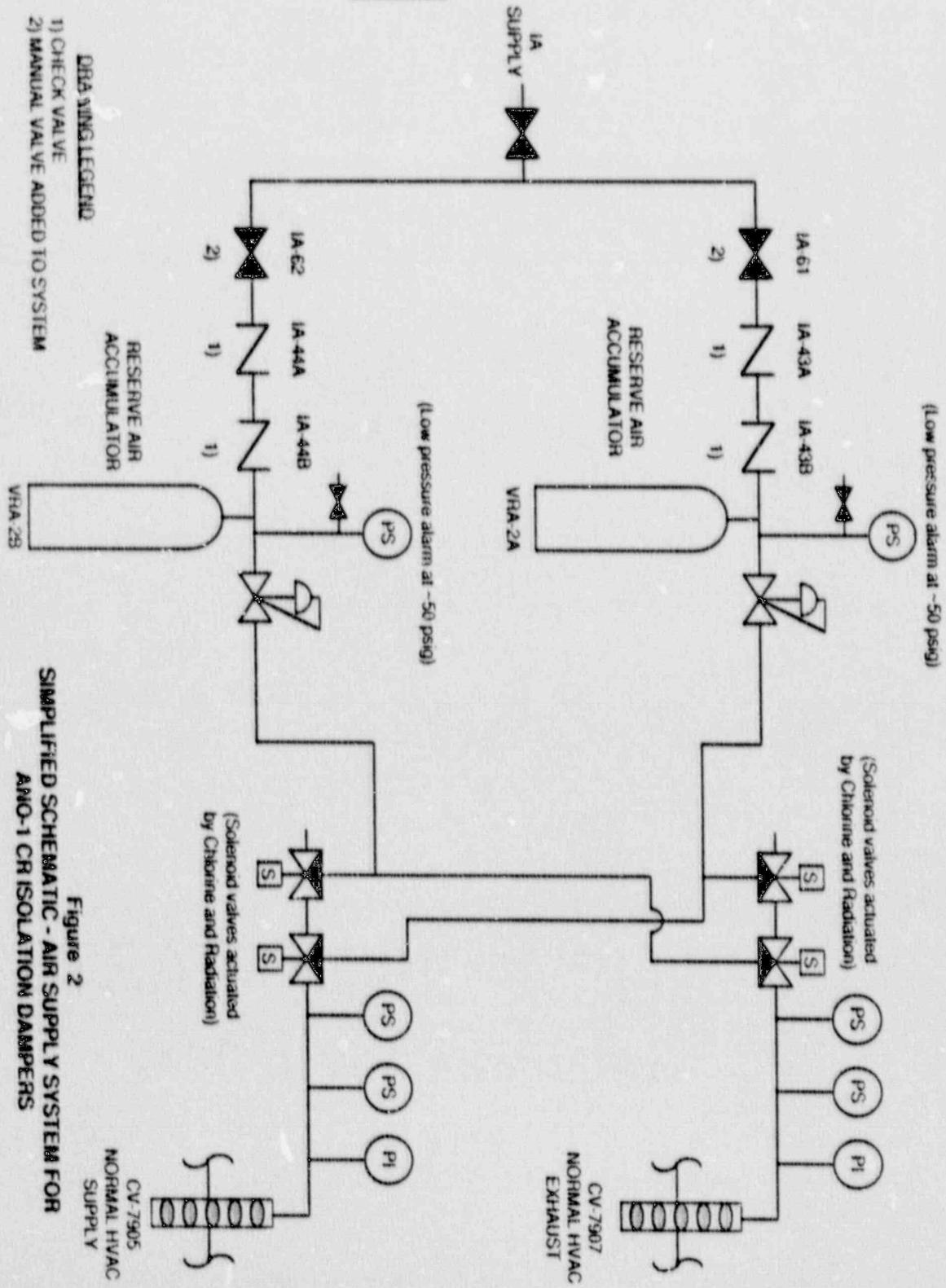

Figure 2
SIMPLIFIED SCHEMATIC - AIR SUPPLY SYSTEM FOR ANO-1 CR ISOLATION DAMPERS