UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

August 11, 1988

NRC INFORMATION NOTICE NO. 88-61: CONTROL ROOM HABITABILITY - RECENT REVIEWS OF OPERATING EXPERIENCE

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to potential problems resulting from design or analysis deficiencies identified in control room ventilation systems. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The NRC has received several construction deficiency and licensee event reports pertaining to safety systems that are used to ensure control room habitability. These reports identified potential safety concerns resulting from design deficiencies, which were attributed to inadequate analysis and an inability to justify those conditions that were assumed in previous evaluations of plant design and operation. These reports are summarized below.

Comanche Peak 1 and 2:

On January 15, 1988, the permit holder determined that radiation doses to control room operators for some postulated radiological accidents could exceed the limits of General Design Criterion 19 of Appendix A to 10 CFR 50. This determination was attributed to an inadequate analysis of control room habitability systems for postulated radiological accidents. Particular accident scenarios that were incompletely analyzed included a fuel handling accident and a rupture of a radioactive gaseous waste tank. To correct this situation, the licensee is developing new calculations, upgrading the existing control room intake radiation monitors and associated cables to safety-related Class 1E requirements, and installing two additional safety-related Class 1E radiation monitors, one in each control room intake.

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Quad Cities:

On November 25, 1987, the licensee's engineering department discovered that design basis assumptions used in the control room habitability study were inconsistent with technical specification requirements. The study was conducted to satisfy a requirement of the NRC's TMI Action Plan. The adsorption efficiencies of the standby gas treatment system and control room HVAC system were assumed at 99 percent for organic iodide removal. The relevant technical specifications, however, require only an organic iodide removal efficiency more than or equal to 90 percent. All the filters meet the technical specification requirements. Since December 31, 1984, tests of filter efficiencies indicate that the relevant assumptions of the study were met with two exceptions. The licensee attributes the cause for this condition to be an inadequate review of design and analysis during the development of the study.

Vogtle 1 and 2:

On July 2, 1987, plant engineering personnel identified an inadequacy in the dose analysis for control room operators. On receipt of a safety injection signal or a control room outside air intake high radiation signal, the control room heating, ventilating, and air conditioning (HVAC) system is automatically transferred from the normal system units to the essential control room (ECR) fan-filter units in the emergency mode of operation. The ECR system consists of two redundant and physically separated 100 percent capacity fan-filter units for each side of the control room, associated with the corresponding reactor unit (four for the combined Unit 1 and Unit 2 control room (Figure 1)). Each of the ECR units belongs to a different safety train, but portions of the outside air intake ductwork and control room supply and return ductwork are common to each of the units. On initiation of the ECR system, the associated motor-operated dampers for the essential units are automatically opened and those for the normal units are automatically closed.

When both of the ECR fan-filter units are operating, loss of power to one of these units can reduce the amount of outside air available to pressurize the control room. This can happen because the dampers losing power fail in the "as-is" position. At the time of the identification of the problem, no backdraft dampers were installed. This degrades the ECR HVAC system by establishing flowpaths through the common ductwork and the ductwork of the failed unit back to the suction of the operating unit, which could potentially reduce the outside air flow to the control room and reduce the control room pressure below the design value. Maintenance of the design control room pressure is required to minimize unfiltered inleakage.

The licensee concluded that the actual effect on control room pressure could not be calculated in the absence of test data and decided to modify the system by installing backdraft dampers, as noted on Figure 1, for the ECR HVAC systems of both Units 1 and 2.

On July 4, 1987, an additional condition was discovered that could have caused an insufficient control room pressure. All ECR systems share common outside air supply ductwork. The common air supply ductwork has intakes from the outside atmosphere associated with both Units 1 and 2. Redundant isolation dampers in series are provided for both Unit 1 and Unit 2 duct openings from the outside atmosphere. During construction, the Unit 2 duct opening had been isolated by locking the dampers closed. If one of the outside air isolation dampers for Unit 1 had closed as the assumed single failure of an active component, no source of outside air would be available to the control room (shared by both Units) and the required pressure would not be maintained. Because the licensee had removed chlorine gas sources from the site, the capability to isolate toxic gases was no longer needed. Thus, the licensee deactivated and tagged open the outside air isolation dampers.

For all these problems, the licensee concluded that the defective conditions would have been discovered earlier with an adequate failure modes and effects analysis.

Beaver Valley 2:

On March 27, 1987, the permit holder determined that timers initiated by containment isolation phase B signals were not served with uninterruptible power as required. These timers are designed to actuate banks of compressed air to supply the control room emergency pressurization system one hour after receipt of the isolation signal. They were powered from the respective fan control circuit energized by an emergency ac distribution panel fed from an emergency motor control center. Loss of offsite power would interrupt power to the motor control center. If a loss of power occurred after timer initiation, the timers would reset to the beginning of the timing cycle and would not begin the cycle until power was restored to the emergency motor control center. The compressed air would thus not be supplied after one hour. To enhance the reliability of the safety systems, the licensee revised the circuitry to power the timers from the Class 1E 125-V dc battery system.

McGuire 1:

On November 5, 1987, the licensee discovered during an 18-month surveillance test of the control area ventilation and chilled water system that control room pressure was below the technical specification requirement. The licensee determined that the cause was leaking seals on seven control room doors. The doors were designed to seal by seating against sealing strips in the door frames. Although not visibly deteriorated, the sealing material apparently had been deformed and compressed over time from normal use of the doors. The licensee adjusted manual volume dampers to increase total train air flow and the proportion of outside air flow to the maximum 60 percent allowed in the

test procedure. This action was effective in increasing control room pressure to meet the technical specification requirement. The licensee installed sealing tape around the seven doors and established a preventive maintenance program to inspect the seals on all control room doors every 6 months for a 1-year period. The licensee plans to determine an appropriate frequency for preventive maintenance of the door seals. The surveillance test of the control area ventilation and chilled water system will also be repeated every 6 months until sufficient information is obtained for determining an appropriate frequency.

Farley 1:

On June 5, 1987, the licensee discovered that none of four fire dampers in the control room ventilation system would fully close and latch with or without air flow because they had not been exercised and/or lubricated or, in one case, because a latch was damaged. In addition, investigation revealed that the dampers would not have received an actuation signal from a Firestat set to sense 160°F in the control room ceiling because of installation errors. The licensee attributed the problems to three causes: a design deficiency pertaining to the full closure and latching of the dampers, inadequate testing of the actuation circuitry, and inadequate preventive maintenance of the dampers.

Discussion:

In addition to the above, the NRC has recently completed an engineering evaluation, "Design and Operating Deficiencies in Control Room Emergency Ventilation Systems," AEOD/E802, April 1988 based on recent events that highlight single failure vulnerabilities in control room emergency ventilation systems.* The NRC also has recently conducted a survey of control room habitability systems at 12 operating plants. Numerous discrepancies were found between the analyzed and actual performance of these systems. For example, differences exist between design, construction, operation, and/or testing of these systems and the descriptions and analyses provided in licensing documents, as for example in the assumptions used in the toxic gas and radiation dose calculations. In addition, analyses assumptions have not always been consistent with technical specification requirements. The NRC has issued several information notices related to this subject (see Attachment 2). Resolution of Generic Issue 83: Control Room Habitability is also ongoing.

*A copy of the report is available in the NRC Public Document Room, 1717 H Street, N.W., Washington, D.C. 20555, for inspection and copying.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Vern Hodge, NRR
(301) 492-1169

Charles R. Nichols, NRR
(301) 492-0854

Attachments:
1. Figure 1. Schematic Air Flow Path Diagram of Essential Control Room Heating, Ventilating, and Air Conditioning System (ECR HVAC) at Vogtle. Assumed Containment Isolation Signal for Unit 1 with Train B Failed.
2. List of Information Notices Related to Control Room Habitability Systems
3. List of Recently Issued NRC Information Notices

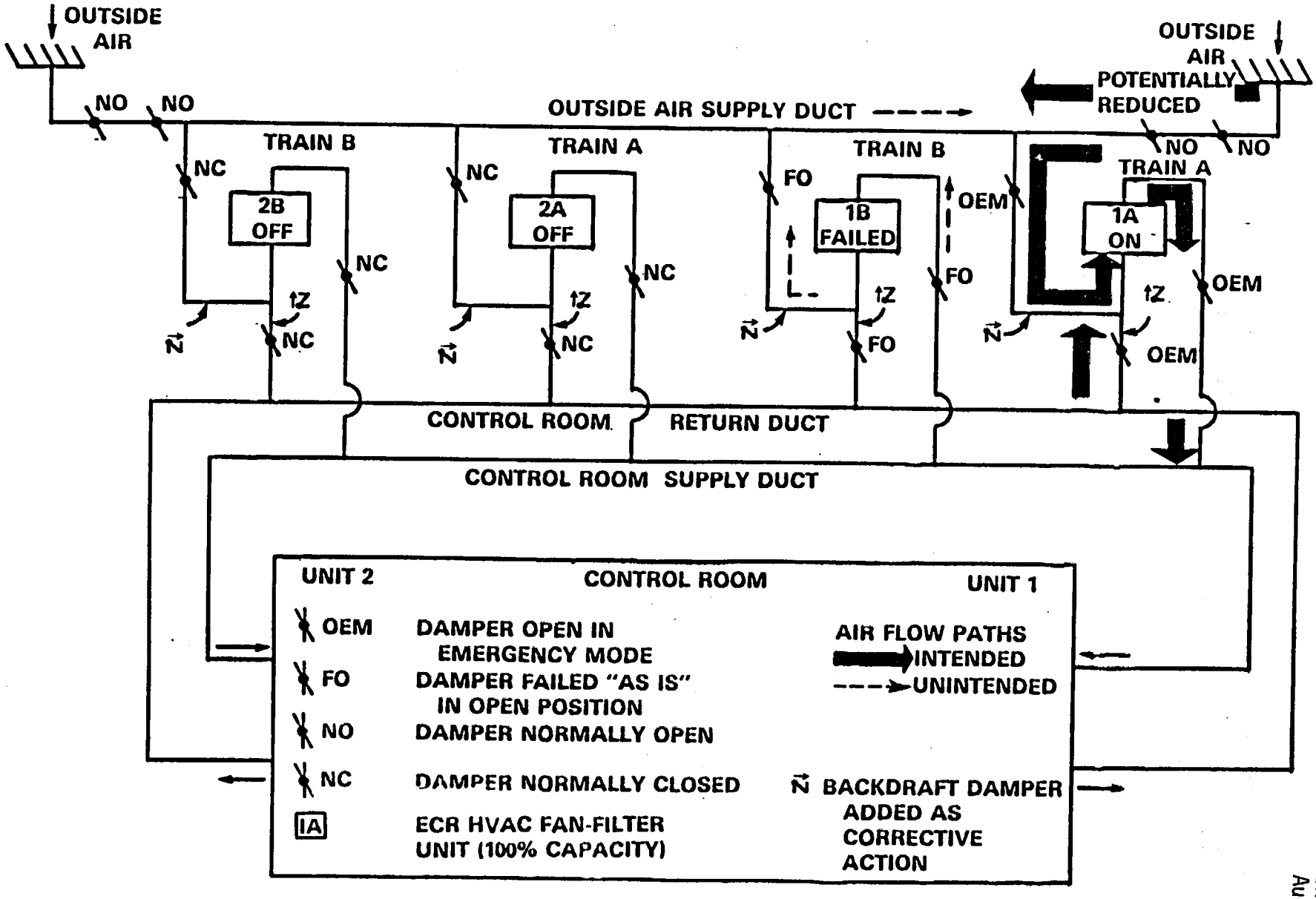

FIGURE 1. SCHEMATIC AIR FLOW PATH DIAGRAM OF ESSENTIAL CONTROL ROOM HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM (ECR HVAC) AT VOGTLE. ASSUMED CONTAINMENT ISOLATION SIGNAL FOR UNIT 1 WITH TRAIN B FAILED.

Attachment 1
IN 88-61
August 11, 1988

LIST OF INFORMATION NOTICES RELATED TO CONTROL ROOM HABITABILITY SYSTEMS

NO.	TITLE	DATE
86-76	Problems Noted in Control Room Emergency Ventilation Systems	August 28, 1986
85-89	Potential Loss of Solid-State Instrumentation Following Failure of Control Room Cooling	November 19, 1985
83-62	Failure of Redundant and Toxic Gas Detectors Positioned at Control Room Ventilation Air Intakes	September 26, 1983

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-60	Inadequate Design and Installation of Watertight Penetration Seals	8/11/88	All holders of OLs or CPs for nuclear power reactors.
88-04, Supplement 1	Inadequate Qualification and Documentation of Fire Barrier Penetration Seals	8/9/88	All holders of OLs or CPs for nuclear power reactors.
88-59	Main Steam Isolation Valve Guide Rail Failure at Waterford Unit 3	8/9/88	All holders of OLs or CPs for nuclear power reactors.
88-58	Potential Problems with ASEA Brown Boveri ITE-51L Time-Overcurrent Relays	8/8/88	All holders of OLs or CPs for nuclear power reactors.
88-57	Potential Loss of Safe Shutdown Equipment Due to Premature Silicon Controlled Rectifier Failure	8/8/88	All holders of OLs or CPs for nuclear power reactors.
88-56	Potential Problems with Silicone Foam Fire Barrier Penetration Seals	8/4/88	All holders of OLs or CPs for nuclear power reactors.
88-55	Potential Problems Caused by Single Failure of an Engineered Safety Feature Swing Bus	8/3/88	All holders of OLs or CPs for nuclear power reactors.
88-54	Failure of Circuit Breaker Following Installation of Amptector Direct Trip Attachment	7/28/88	All holders of OLs or CPs for nuclear power reactors.
88-53	Licensee Violations of NRC Regulations, Which Led to Medical Diagnostic Misadministrations	7/28/88	All manufacturers and distributors of radiopharmaceuticals for human use, nuclear pharmacies, and mecical licensees.

OL = Operating License
CP = Construction Permit

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*SEE PREVIOUS CONCURRENCES

		D/DOEA:NRR	*C/OGCB:DOEA:NRR	*PPMB:ARM
		CERossi	CHBerlinger	TechEd
		08/16/88	05/31/88	04/05/88
*OGCB:DOEA:NRR	*SPLB:DEST:NRR	*A/C/SPLB:DEST:NRR	*SAD/DEST:NRR	*D/DEST:NRR
CVHodge	CRNichols	JWCraig	AThadani	LCShao
03/31/88	03/31/88	05/06/88	05/13/88	05/16/88

habitability systems at 12 operating plants. Numerous types of discrepancies are described involving differences between (1) the design, construction, operation and/or testing of these systems and (2) corresponding technical specifications when compared with the descriptions and analyses provided in licensing basis documents, including assumptions in the toxic gas and radiation dose calculations.

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2. Figure 1. Schematic Flow Path Diagram of Essential Control Room Heating, Ventilating, and Air Conditioning System at Vogtle 1 and 2
3. List of References
4. List of Recently Issued NRC Information Notices

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control room habitability systems at 12 operating plants. Numerous types of discrepancies are described between the design, construction, operation and testing of these systems and corresponding technical specifications compared with the descriptions and analyses provided in licensing basis documents, including assumptions in the toxic gas and radiation dose calculations. The NRC plans to distribute the report to all holders of operating licenses or construction permits for nuclear power reactors.

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