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

November 1, 1990

NRC INFORMATION NOTICE NO. 89-30, SUPPLEMENT 1: HIGH TEMPERATURE ENVIRONMENTS AT NUCLEAR POWER PLANTS

Addressees:

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

Purpose:

This information notice supplement is being provided to present additional information regarding the effects of elevated room temperature on the operability of safety related equipment as discussed in NRC Information Notice 89-30, issued March 15, 1989. 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:

Information Notice No. 89-30 described events where elevated temperatures and high humidity within the drywell or containment adversely impacted the operability of safety related equipment. This supplement describes events where high ambient temperatures in areas other than the containment or the drywell caused the failure or degradation of safety related equipment.

On June 25, 1990, the Omaha Public Power District (the licensee) conducted a full load test on the No. 1 emergency diesel generator (EDG) at Fort Calhoun Unit 1. This test was conducted to establish a temperature profile for the EDG room. The test was terminated when the output from the generator became erratic as a result of the failure of a transistor in the static exciter circuitry.

The licensee's investigation revealed that the transistor had failed because of the effects of elevated temperatures in the static exciter/voltage regulator cabinet which was located in the EDG room. Temperatures in the cabinet had reached 140 degrees Fahrenheit (F) during the test. The transistor was replaced and the EDG was returned to operable status. The licensee also discovered elevated temperatures in the static exciter/voltage regulator cabinet for the No. 2 EDG. In a recently completed engineering analysis, the licensee verified that because of inadequate cabinet ventilation, a potential common mode failure of both EDGs exists. The analysis also concluded that this condition has likely existed since plant startup.

IDHR-11C

To reduce the potential for heat buildup in the cabinets, the cabinet doors were temporarily removed until a long term solution to the problem can be formulated. The licensee's investigation of this event also revealed that elevated room temperatures significantly impact the operating efficiency of the EDGs and could lead to accelerated degradation.

Discussion:

The Fort Calhoun Station has two General Motors EMD 20-645E4 diesel generator sets. The cooling system for each EDG consists of an engine radiator, an engine-driven fan, and a pump that circulates cooling water through the engine and radiator. Outside air is drawn into the EDG room by the fan, is blown across the radiator, and exits through the roof of the building through air ducts. Inlet air for the diesel turbocharger is drawn directly from the EDG room.

In June 1988 the licensee modified the hangers on the diesel exhaust headers. These modifications required that the insulating material on the headers be removed. After removing the insulating material, the licensee was aware that ambient temperature would increase. Therefore, the licensee performed an analysis to support a design change that would allow the exhaust headers to remain uninsulated. The analysis concluded that bulk temperature in the EDG rooms would rise by only 9 degrees F and that this increase would not have an adverse effect on the operability of the EDGs. The analysis did not specifically address the effect of elevated room temperature on other equipment located in the room.

When test runs were made during the summer months of 1989, the licensee found that bulk room temperatures actually increased approximately 20 degrees F, or more than twice the increase predicted by the licensee's analysis. This elevated room temperature likely accelerated the degradation of the exciter component that failed. However, the potential for the temperature buildup in the unvented cabinet probably existed since the cabinets were installed.

The licensee also has determined that the 20 degree rise in ambient temperature resulted in an increase in jacket water temperature and turbocharger inlet air temperature. These temperature increases adversely affect engine operating efficiency. Depending on the amount of increase, elevated jacket water temperature and/or turbocharger inlet air temperature, combined with heavy loading, may lead to accelerated degradation of the engine. This degradation could result in engine failure or prevent the engine from meeting its designed run time as assumed in the Final Safety Analysis Report. To reduce the potential for engine degradation while operating during periods of high ambient temperatures, unit loading would have to be limited. Derating the EDG could result in the unit's dependable output capability being less than required for design basis accident loads.

Because of variations in the configurations of intake air systems, turbocharger inlet air may be preheated significantly. The temperature of the air entering the turbocharger may be much higher than air temperature elsewhere. Also, water-to-air heat exchangers are more sensitive to changes in ambient temperature

than are water-to-water heat exchangers. However, an increase in service water temperature in water-to-water heat exchangers may also result in the derating of an EDG. The NRC is aware of other instances in which elevated ambient temperatures resulted in the failure or degradation of safety related components.

To avoid excessive cabinet temperatures and subsequent component failures, the licensee for the Washington Nuclear Project, Unit 2, has instituted administrative procedures to remove the doors from the static exciter voltage regulator cabinet when the EDG room temperature exceeds 90 degrees F. The licensee performed an analysis which concluded that internal temperatures in the cabinets would exceed the long-term (greater than 24 hours) thermal rating of the cabinet components if the EDG room temperature were to exceed 90 degrees F. Extended operation at or above this temperature would significantly increase the probability of a component failure.

On December 16, 1985, the failure of a fan in an engineered safety features (ESF) cabinet at Palo Verde Unit 1 resulted in the spurious actuation of several ESF signals. These signals initiated the automatic start of the Train A EDG, caused loads to be shed from the Train A vital bus, and initiated the operation of the ESF load sequencer. The load shed signal did not clear, prohibiting the automatic or manual sequencing of ESF electrical loads. The licensee installed a control room alarm that annunciates on cabinet exit air high temperature.

On June 4, 1984, at the McGuire Station, a total loss of control area ventilation resulted in temperature build-up in instrumentation cabinets. The elevated temperatures initiated several spurious solid state protection system alarms and resulted in the operators having to reduce output from both generating units. This event is described in detail in IE Information Notice No. 85-89, "Potential Loss of Solid State Instrumentation Following Failure of Control Room Cooling."

On September 21, 1982, a similar event occurred at Davis-Besse Unit 1, and involved the failure of a 48-volt power supply in the Steam and Feedwater Rupture Control System (SFRCS). The failure of the power supply was attributed to heat buildup in the SFRCS cabinets. The licensee installed fans in the cabinets to ensure more effective cooling.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

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

Technical Contacts: C. Paulk, Region IV
(817) 860-8236

N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-69	Adequacy of Emergency And Essential Lighting	10/31/90	All holders of OLs or CPs for nuclear power reactors.
90-68	Stress Corrosion Cracking of Reactor Coolant Pump Bolts	10/30/90	All holders of OLs or CPs for pressurized water reactors (PWRs).
90-67	Potential Security Equipment Weaknesses	10/29/90	All holders of OLs or CPs for nuclear power reactors and Category I fuel facilities.
90-66	Incomplete Draining and Drying of Shipping Casks	10/25/90	All holders of OLs for nuclear power reactors and all registered users of NRC approved waste shipping packages.
88-63, Supp. 1	High Radiation Hazards From Irradiated Incore Detectors and Cables	10/5/90	All holders of OLs or CPs for nuclear power reactors.
90-65	Recent Orifice Plate Problems	10/5/90	All holders of OLs or CPs for nuclear power reactors.
90-64	Potential for Common-Mode Failure Of High Pressure Safety Injection Pumps or Release of Reactor Coolant Outside Containment During A Loss-Of-Coolant Accident	10/4/90	All holders of OLs or CPs for pressurized-water reactors.

OL = Operating License
CP = Construction Permit

than are water-to-water heat exchangers. However, an increase in service water temperature in water-to-water heat exchangers may also result in the derating of an EDG. The NRC is aware of other instances in which elevated ambient temperatures resulted in the failure or degradation of safety related components.

To avoid excessive cabinet temperatures and subsequent component failures, the licensee for the Washington Nuclear Project, Unit 2, has instituted administrative procedures to remove the doors from the static exciter voltage regulator cabinet when the EDG room temperature exceeds 90 degrees F. The licensee performed an analysis which concluded that internal temperatures in the cabinets would exceed the long-term (greater than 24 hours) thermal rating of the cabinet components if the EDG room temperature were to exceed 90 degrees F. Extended operation at or above this temperature would significantly increase the probability of a component failure.

On December 16, 1985, the failure of a fan in an engineered safety features (ESF) cabinet at Palo Verde Unit 1 resulted in the spurious actuation of several ESF signals. These signals initiated the automatic start of the Train A EDG, caused loads to be shed from the Train A vital bus, and initiated the operation of the ESF load sequencer. The load shed signal did not clear, prohibiting the automatic or manual sequencing of ESF electrical loads. The licensee installed a control room alarm that annunciates on cabinet exit air high temperature.

On June 4, 1984, at the McGuire Station, a total loss of control area ventilation resulted in temperature build-up in instrumentation cabinets. The elevated temperatures initiated several spurious solid state protection system alarms and resulted in the operators having to reduce output from both generating units. This event is described in detail in IE Information Notice No. 85-89, "Potential Loss of Solid State Instrumentation Following Failure of Control Room Cooling."

On September 21, 1982, a similar event occurred at Davis-Besse Unit 1, and involved the failure of a 48-volt power supply in the Steam and Feedwater Rupture Control System (SFRCS). The failure of the power supply was attributed to heat buildup in the SFRCS cabinets. The licensee installed fans in the cabinets to ensure more effective cooling.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

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

Technical Contacts: C. Paulk, Region IV
(817) 860-8236

N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

* See previous concurrence

OFC	:NRR:EAB	:REGION IV	:TECH ED	:SC/NRR/EAB	:BC/NRR/EAB	:BC/NRR/GC	:DD/NRR/DOEA
NAME	:*EFIELDS	:*CPAULK	: *	:DFISHER	:ACHAFFEE	:CBERLINGER	:CROSSI
DATE	: / /90	: / /90	: / /90	: / /90	: / /90	: / /90	:10/29/90

Document Name: 89-30, SUPP. 1

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

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

Technical Contact: C. Paulk, Region IV
(817) 860-8236 CR
N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

* See previous concurrence

OFC	:NRR:EAB	:REGION IV	:TECH ED	:SC/NRR/EAB	:BC/NRR/EAB	:BC/NRR/GC	:DD/NRR/DOEA
NAME	:*EFIELDS	:*CPAULK	: *	:DFISHER	:ACHAFFEE	:CBERLINGER	:CROSSI
DATE	:	:	:	: 10/22/90	:10/22/90	: 10/24/90	:

Document Name: FTCALHOUN IN

To avoid excessive cabinet temperatures and subsequent component failures, the licensee for the Washington Nuclear Project, Unit 1, has instituted administrative procedures to remove the doors from the static exciter voltage regulator cabinet when the EDG room temperature exceeds 90 degrees F. The licensee performed an analysis which concluded that internal temperatures in the cabinets would exceed the long-term (greater than 24 hours) thermal rating of the cabinet components if the EDG room temperature were to exceed 90 degrees F. Extended operation at or above this temperature would significantly increase the probabilty of a component failure.

On June 4, 1984, at the McGuire Station, a total loss of control area ventilation resulted in temperature build-up in instrumentation cabinets. The elevated temperatures initiated several spurious solid state protection system alarms and resulted in the operators having to reduce output from both generating units. This event is described in detail in IE Information Notice No. 85-89, "Potential Loss of Solid State Instrumentation Following Failure of Control Room Cooling."

On September 21, 1982, a similar event occurred at Davis-Besse Unit 1, and involved the failure of a 48-volt power supply in the Steam and Feedwater Rupture Control System (SFRCS). The failure of the power supply was attributed to heat build-up in the SFRCS cabinets. The licensee installed fans in the cabinets to ensure more effective cooling.

On December 16, 1985, the failure of a fan in an engineered safety features (ESF) cabinet at Palo Verde Unit 1 resulted in the spurious actuation of several ESF signals. These signals initiated the automatic start of the Train A EDG, caused loads to be shed from the Train A vital bus, and initiated the operation of the ESF load sequencer. The load shed signal did not clear, prohibiting the automatic or manual sequencing of ESF electrical loads. The licensee installed a control room alarm that annunciates on cabinet exit air high temperature.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

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

Technical Contact: C. Paulk, Region IV
(817) 860-8236

N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

* See previous concurrence

OFC	:NRR:EAB	:REGION IV	:TECH ED	:SC/NRR/EAB	:BC/NRR/EAB	:BC/NRR/GC	:DD/NRR/DOEA
NAME	:EFIELDS ENF	:CPAULK EVE for	: *	:DFISHER	:ACHAFFEE	:CBERLINGER	:CROSSI
DATE	: 10/5/90	: 10/5/90	:	: 10/19/90	:	:	:

OFFICIAL RECORD COPY

Document Name: FTCALHOUN IN

To avoid excessive cabinet temperatures and subsequent component failures, the licensee for the Washington Nuclear Project Unit 1 has instituted administrative procedures to remove the static exciter voltage regulator cabinet doors when the EDG room temperature exceeds 90 degrees F. The licensee performed an analysis which concluded that internal temperatures in the cabinets would exceed the long-term (greater than 24 hours), thermal rating of the cabinet components if the EDG room temperature were to exceed 90 degrees F. Extended operation at this temperature or higher would significantly increase the probabilty that a component failure would occur.

On June 4, 1984, at the Mcquire Station, a total loss of control area ventilation resulted in temperature build-up in instrumentation cabinets. The elevated temperatures initiated several spurious solid state protection system alarms and resulted in a operators having to reduce output from both generating units. This event is described in detail in IE Information Notice No. 85-89, "Potential Loss of Solid State Instrumentation Following Failure of Control Room Cooling".

A similar event occurred at Davis-Besse 1 on September 21, 1982 and involved the failure of a 48-volt power supply in the Steam and Feedwater Rupture Control System (SFRCS). The failure of the power supply was attributed to heat build-up in the SFRCS cabinets. The licensee installed fans in the cabinets to ensure more effective cooling.

On December 16, 1985, the failure of a fan in an engineered safety features (ESF) cabinet at Palo Verde Unit 1 resulted in the spurious actuation of several ESF signals. A spurious auto-start of the train A EDG, operation of the ESF load sequencer, and a train A load shed signal. The load shed signal did not clear, prohibiting the automatic or manual sequencing of ESF electrical loads. The licensee installed a control room alarm which annunciate on high cabinet exit air temperature.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate NRR project manager.

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

Technical Contact: C. Paulk, Region IV
(817) 860-8236

N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

OFC	:NRR:EAB	:REGION IV	:TECH ED	:SC/NRR/EAB	:BC/NRR/EAB	:BC/NRR/GC	:DD/NRR/DOEA
NAME	:NFIELDS	:CPAULK	:JMainGM	:DFISHER	:ACHAFFEE	:CBERLINGER	:CROSSI
DATE	:	:	: 10/4/90	:	:	:	:

OFFICIAL RECORD COPY

Document Name: FTCALHOUN IN