POLICY ISSUE
(Information)

April 14, 1992 SECY-92-131

For: The Commissioners

From: James M. Taylor
Executive Director for Operations

Subject: REPLY TO COMMISSION'S QUESTIONS ON VOGTLE'S DIESEL GENERATORS AND ASSOCIATED INSTRUMENTATION

Purpose: To provide information requested by the Commission in a memorandum dated February 27, 1992, concerning operation of the diesel generators (DGs) and their associated instrumentation at the Vogtle Electric Generating Plant, Units 1 and 2.

Summary: The staff presents reasons for allowing the licensee to retain certain temperature sensors at Vogtle, amplifies its previous statement on the availability of the redundant DG, and addresses the relationship between General Design Criterion (GDC) 17 and Regulatory Guide (RG) 1.9, "Selection, Design, and Qualification of Diesel-Generator Units Used as Standby (Onsite) Electric Power Systems at Nuclear Power Plants."

Background: In CLI-92-03, the Commission acted on an appeal filed by Georgians Against Nuclear Energy (GANE) from an Atomic Safety and Licensing Board decision, LBP-91-21, 33 NRC 419 (1991), which

NOTE: TO BE MADE PUBLICLY AVAILABLE IN 10 WORKING DAYS FROM THE DATE OF THIS PAPER

Contact: David B. Matthews, NRR
504-1490

dismissed GANE's proposed contentions and denied the petition to intervene on amendments to the Georgia Power Company's operating licenses for the Vogtle facility. The amendments authorized the licensee to bypass the high jacket water temperature trip of the DGs for unplanned starts. In its memorandum of February 27, 1992, to the Executive Director for Operations, the Commission noted that although the Commission had dismissed GANE's appeal, the staff should provide the Commission additional information on three items concerning operation of the DGs and their associated instrumentation.

Discussion: The Commission's three requests and the staff's responses follow:

1. The staff should inform the Commission whether the licensee has replaced or plans to replace the Calcon pneumatic sensors used in Vogtle's diesel generator instrumentation. In this regard, the Commission notes that various documents filed before the Licensing Board indicate that the licensee was considering replacement of the sensors. If the Calcon sensors have not been replaced, the staff should explain the rationale for the continued acceptability of the sensors.

Staff's Reply

In a letter of March 13, 1992, the licensee stated that it has concluded that replacing the California Controls Company (Calcon) Model A3500 temperature sensors and their associated pneumatically-controlled instrumentation is not a practical option at the present time. The licensee considered an alternative of using electronic sensors and instrumentation, but found this alternative to be an unproven design that has unproven reliability and that did not provide reasonable expectation of improved performance. The licensee found that, unlike the alternative, the Calcon jacket water temperature sensors used at Vogtle provide reasonable assurance that the trip logic associated with jacket water temperature will function as designed during nonemergency operation.

The licensee continues to explore replacing the sensors with an electronic alternative. The licensee plans to examine adding "parameter monitoring" sensors to demonstrate reliability, before reaching final conclusions for replacing trip-related sensors. Moreover, the licensee believes that it will need to obtain actual experience and perform further review before it can apply this alternate instrumentation.

The staff does not believe that the licensee needs to replace the Calcon sensors. After the March 20, 1990, loss of offsite power event at Vogtle Unit 1, the licensee removed all eight Calcon temperature sensors from the two DGs and sent them to Wyle Laboratories for evaluation and tests. Upon conducting these tests, Calcon and Wyle Laboratories made several recommendations to improve the calibration and operation of Calcon temperature sensors. These recommendations are listed in the NRC staff's enclosed letter of July 17, 1990, to the Transamerica Delaval Incorporated Owners Group, and include factors to enhance calibration procedures, setpoint drift, and the presence of foreign material in the temperature sensors. The licensee implemented each of the recommendations at Vogtle by June 26, 1990. Since these improvements were implemented at Vogtle, no DGs have failed because of Calcon sensors. In view of this favorable operating performance, the staff believes that the licensee does not need to replace the Calcon sensors. The staff also notes that since these sensors are bypassed during accident conditions, they do not affect the operability of the DGs during an emergency.

2. The staff should inform the Commission of the justification for the acceptability of mid-loop operation at Vogtle with a single available diesel generator. In this regard, the Commission notes that the staff's safety

evaluation for the amendment indicates that, if a diesel generator fails due to a loss of engine cooling, emergency onsite AC power would be provided by the redundant diesel generator and its associated electrical train. Only one diesel generator was, however, operable during the March 1990 Vogtle loss-of-power event.

Staff's Reply

The Commission correctly noted that, in the staff's safety evaluation for Vogtle Amendments 31 (Unit 1) and 11 (Unit 2), the staff stated that, if a DG should fail from a loss of engine cooling, the redundant DG and associated electrical train would provide emergency onsite ac power. However, this statement applies to the power modes for which Technical Specification (TS) 3.8.1.1 requires, in part, that two separate and independent DGs are to be operable. The statement does not apply to the shutdown modes (including mid-loop operation) for which TS 3.8.1.2 requires, in part, that at least one DG is to be operable. Having only one DG operable during mid-loop operation is acceptable at the present time under the present TS.

The NRC staff is reevaluating the shutdown and low-power operations of all domestic nuclear power plants. On February 25, 1992, the staff discussed the results of its technical evaluation in SECY-92-067, "Evaluation of Shutdown and Low-Power Operation," which included NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States - Draft Report for Comment." The staff concludes in the NUREG, based on operating experience and risk assessment, that the requirement to have only one DG operable is not appropriate for some shutdown conditions (such as mid-loop operation). The staff also found that past STS for electrical systems have been poorly integrated with technical specifications for other systems that the electrical systems must support. The staff concluded that improved technical specifications is one of several areas that should be further evaluated. Moreover, the staff found that with proper planning, maintenance on electrical systems can be accommodated during shutdown conditions of less risk significance. Consequently, the staff is developing improvements to technical specifications for electrical systems which (1) ensure a minimum level of electrical system availability in all plants, (2) balance the need for higher availability of electrical systems during some shutdown conditions and the need to perform maintenance during shutdown operations, and (3) bring logic and consistency to an area of nuclear plant operation that has been cumbersome for both plant operators and regulators. Upon receiving the approval of the Committee to Review Generic Requirements, the staff expects to issue improved standard technical specifications by June 30, 1992.

3. The staff should inform the Commission of its views as to whether the guidance in Regulatory Guide 1.9, which permits reliance on operator action when certain diesel generator trips are bypassed, is necessary to meet, or goes beyond, the requirements of 10 CFR Part 50, Appendix A, Criterion 17. If the guidance goes beyond Appendix A requirements, are there other areas in the Regulatory Guide which also go beyond Appendix A requirements?

Staff's Reply

The staff's judgement is that the cited guidance in RG 1.9 is necessary to meet, and does not go beyond, the requirements of 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 17. This judgement is based on the following rationale.

The basic requirement of interest is embodied in the first paragraph of GDC-17, as it applies to the onsite electric power system.

This requirement is that, assuming the offsite system is not available, the safety function of the onsite electric power system

> shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.

Redundant and highly reliable emergency DGs are a prerequisite for meeting this requirement. The staff provided the guidance in RG 1.9 to enhance DG reliability by minimizing spurious DG protective trips. This guidance provides for implementing protective trips either (1) by redundant sensors with coincident logic for trip actuation, or (2) by trip bypass under accident conditions if the operator has sufficient time to react appropriately to an abnormal DG condition. The staff developed this guidance to address the high frequency of spurious protective trips that occurred during DG surveillance testing conducted in the early 1970s. The staff recognized that these trips could adversely affect plant safety when DGs were most needed.

A design of protective trips using redundant sensors and coincident logic would reduce the probability of spurious trips. If a trip occurred, the redundant DG would be available to power the accident loads. However, if the redundant DG had failed previously or was unavailable, this trip (valid or spurious) would result in the loss of all ac power during an accident.

A design using the trip bypass option of RG 1.9 would eliminate spurious (or valid) automatic DG protective trips. However, each bypassed parameter would be alarmed before it exceeded the "bypassed trip" setpoint. The operator can then assess overall plant conditions before deciding what action to take. If the redundant DG was operable and providing power to its safety train with the plant in an accident condition, the likely choice would be to secure the "alarmed" DG to prevent serious damage. If the redundant DG was not operable, then the likely choice would be to allow the DG to operate until it failed in order to gain time for the continuing efforts to restore another source of ac power. Typically, the control room operator has all the DG status information and control capability needed to take action from the control room to protect the DG, if such action is needed.

The scenarios described herein are very unlikely. However, they are derived directly from the postulated occurrences and the functional requirements for the onsite electric power system contained in GDC 17.

The staff believes that the basis for the bypass position remains valid and that no changes are warranted, although some changes have been made to clarify the proposed revision to RG 1.9, scheduled to be issued for public comments as part of the resolution of Generic Safety Issue B-56, "Diesel Reliability."

Coordination: The Office of the General Counsel has reviewed this response and has no legal objections.

James M. Taylor
Executive Director
for Operations

Enclosure:
NRC's Letter of July 17, 1990, to the Transamerica Delaval Incorporated Owners Group

DISTRIBUTION:
Commissioners
OGC
OCAA
OIG
REGION II
EDO
ACRS
SECY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

July 17, 1990

Mr. Alden Segrest
TDI Owners Group
P.O. Box 36911
Charlotte, North Caroline 28236

Dear Mr. Segrest:

SUBJECT: POTENTIAL MALFUNCTIONS OF CALIFORNIA CONTROL COMPANY MODEL A3500 TEMPERATURE SENSORS

This letter is intended to alert TDI Owners Group members to potential malfunctions of California Controls Company (Calcon) Model A3500 temperature sensors. These sensors are used on diesel generators (DG) manufactured by Transamerica Delaval Incorporated (TDI) to prevent operation of the DG when the jacket water temperature or the lube oil temperature exceeds a high-temperature set point. It is expected that you will review the information for applicability to your facilities and consider actions, as necessary, to avoid similar problems. However, suggestions contained in this letter do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On March 20, 1990, a loss of offsite power occurred at the Alvin W. Vogtle, Jr., Plant, Unit 1. At the time of this event one Emergency Diesel Generator (EDG-1B) was out of service for maintenance. The operable EDG (EDG-1A) was auto-started, but tripped after approximately 70 seconds on high jacket water temperature (two-out-of-three sensor logic). The EDG was restarted, but tripped again after approximately 80 seconds for the same reason. Successful restart was accomplished only after the high jacket water temperature trip was bypassed.

Subsequent testing of the jacket water temperature response of EDG-1A revealed that the jacket water temperature had not increased to the temperature trip set point (200°F) during this event. Further testing of the EDG air start system revealed that one Calcon temperature sensor leaked air, while the setpoint on a second Calcon temperature sensor had drifted from 200°F to approximately 165°F; which is the normal EDG jacket water operating temperature.

Discussion of Safety Significance:

Following the event at Vogtle, the licensee removed all eight Calcon temperature sensors from the two EDGs; three from the jacket water header of each EDG, and one from the lube oil system of each EDG. These were sent to Wyle Laboratories (Wyle) for evaluation and tests. It appears that inadequate calibration procedures, setpoint drift, and the presence of foreign material in the temperature sensors had contributed to the tripping of the temperature sensors at temperatures significantly below their intended setpoint. Such unnecessary trips of the EDGs can impede the restoration of electrical power to plant safety systems.

Tests conducted by Wyle identified several factors that can significantly affect the proper calibration and operation of Calcon temperature sensors. The following discussion addresses these factors and provides some recommendations from Wyle and Calcon that would improve their performance and reliability.

A schematic showing the major components of a Calcon temperature sensor is shown in Figure 1. The temperature sensor is shown in the tripped state, without a thermowell and with a loose spacer tube.

1. Foreign material in the temperature sensor - During disassembly of leaking temperature sensors, Wyle discovered thread shavings (apparently from the air supply port threads) and excess thread sealant in the poppet seat region of the temperature sensor (Item 1 in Figure 1). The foreign material can prevent an air-tight seal between the poppet seat and the poppet head orifice, and thereby cause the temperature sensor to leak air and be placed in a tripped state. After Wyle cleaned the poppet seat and the air supply port they were able to properly calibrate the affected temperature sensors.

   Wyle and Calcon recommend that licensees avoid the use of excessive thread sealant on the air supply swage-lock fitting, and that the temperature sensor threads in the air supply inlet be cleaned and deburred before installing the swage-lock fitting into the air supply port.

2. Thermowell setscrew tightness - The temperature sensor is secured in its thermowell with a setscrew (Item 2 in Figure 1). Wyle performed calibration checks with the setscrew loosened, and observed a 2°F increase in the trip temperature. This change is apparently caused by the resulting loss of hard contact between the temperature sensor and the thermowell, which decreases the heat transfer rate from the bath to the temperature sensor, and thereby delays the temperature sensor response to changing water temperatures.

   Wyle recommends performing calibrations with the thermowell setscrew tightened.

3. Spacer tube position - The spacer tube is located between the probe and the body of the temperature sensor, and screws into the base of the temperature sensor body (Item 3 in Figure 1). Wyle tested the setpoint sensitivity to the looseness of the spacer tube and determined that the temperature sensor setpoint decreases approximately 80°F for each full turn that the spacer tube is loosened.

Wyle and Calcon recommend applying a thread-locking compound to the spacer tube threads to ensure that the spacer tube remains in its tightened position during for all calibrations, tests, and in-service use.

4. Contaminants on the temperature sensor probe - During testing by Wyle, the temperature sensors were placed directly into a water bath (without using a thermowells) to determine if the absence of a thermowell effected the accuracy of the calibration and trip setpoint. Subsequent calibration checks revealed a 10°F decrease in temperature sensor trip setpoint over a period of several hours. Wyle speculated that this trend was caused primarily by hard water deposits on the Viton O-ring portion of the sensor probe (Item 4 in Figure 1). After the hard water deposits were removed by cleaning the sensors with Dow Corning 200 fluid (silicon oil) and the sensors were installed in thermowells, subsequent cali .ations and calibration checks.

   Wyle and Calcon recommend that the temperature sensors be calibrated with the sensor installed in a thermowell and not be immersed directly in water.

5. Handling of the temperature sensor probe - Twisting the temperature sensor probe (Item 5 in Figure 1) can affect the temperature sensor setpoint in much the same manner as turning the calibration disk the same number of turns in the opposite direction.

   Calcon recommends that the temperature sensor be transported to and from the EDG in a thermowell, and not be removed from the thermowell except when necessary.

6. Insufficient temperature stabilization before calibration - Wyle calibrated two new temperature sensors after heating the temperature sensors in a 180°F water bath for 15 minutes. Subsequent calibration checks indicated a 4°F upward shift of the setpoint after two hours in the temperature bath. Further tests revealed that a two-hour heatup p[illegible] at approximately 165°F preceding temperature sensor calibration w[illegible] revent this setpoint drift.

7. Temperature bath heatup rate - In performing tri[illegible] tpoint calibration tests the sensor in its thermowell is soaked in [illegible] gh temperature bath for sufficient time to reach equilibrium. [illegible]en the bath temperature is raised until the sensor trips. Tests at Wyle indicated that slow bath heatup rates (approximately 1°F per minute) allow the thermowell internal temperature to more closely follow the bath temperature. A slow heatup rate caused the temperature sensor to trip at a higher indicated temperature (relative to the thermowell reference temperature) than did a fast heatup rate (for example, 4°F per minute). Wyle concluded that calibration of a temperature sensor using a fast heatup rate effectively results in a lower trip setpoint setting.

   Wyle recommends limiting the rate of temperature change to 1°F per minute for all calibrations and setpoint checks.

8. Setpoint reference temperature - During trip setpoint calibration tests Wyle monitored the bath temperature with a thermocouple mounted in a thermowell, and with a thermocouple immersed into the bath. The response of the temperature sensor more closely followed that of the thermocouple in the bath than that of the thermocouple in the thermowell.

   Calibration of the temperature sensor using the reference bath temperature instead of the reference thermowell temperature will result in a setpoint that is more representative of the jacket water temperature. Additionally, locating the reference thermocouple adjacent to the temperature sensor thermowell will allow for the best representation of the bath temperature at the thermowell location.

   Additionally, Calcon states significent calibration drift of digital thermocouples has been observed to occur over periods as short as one week. Calcon recommends the use of a mercury thermometer in the test bath to ensure accuracy of the thermocouple data.

Based on these findings, TDI Owners Group members may wish to inspect each Calcon temperature sensor (1) to ensure there is no foreign material in the temperature sensor body, (2) to verify the tightness of the temperature sensor spacer tube, and (3) to verify that the setpoint of each temperature sensor was established using procedures that incorporate the recommendations discussed herein.

This letter requires no specific action or written response. If you have any questions about the information in this letter, please contact Mr. Michael E. Waterman, (301) 492-0818, or the appropriate NRR project manager.

Sincerely,

Carl H. Berlinger

Carl H. Berlinger, Chief
Generic Communications Branch
Office of Nuclear Reactor Regulation

cc: Rick J. Deece

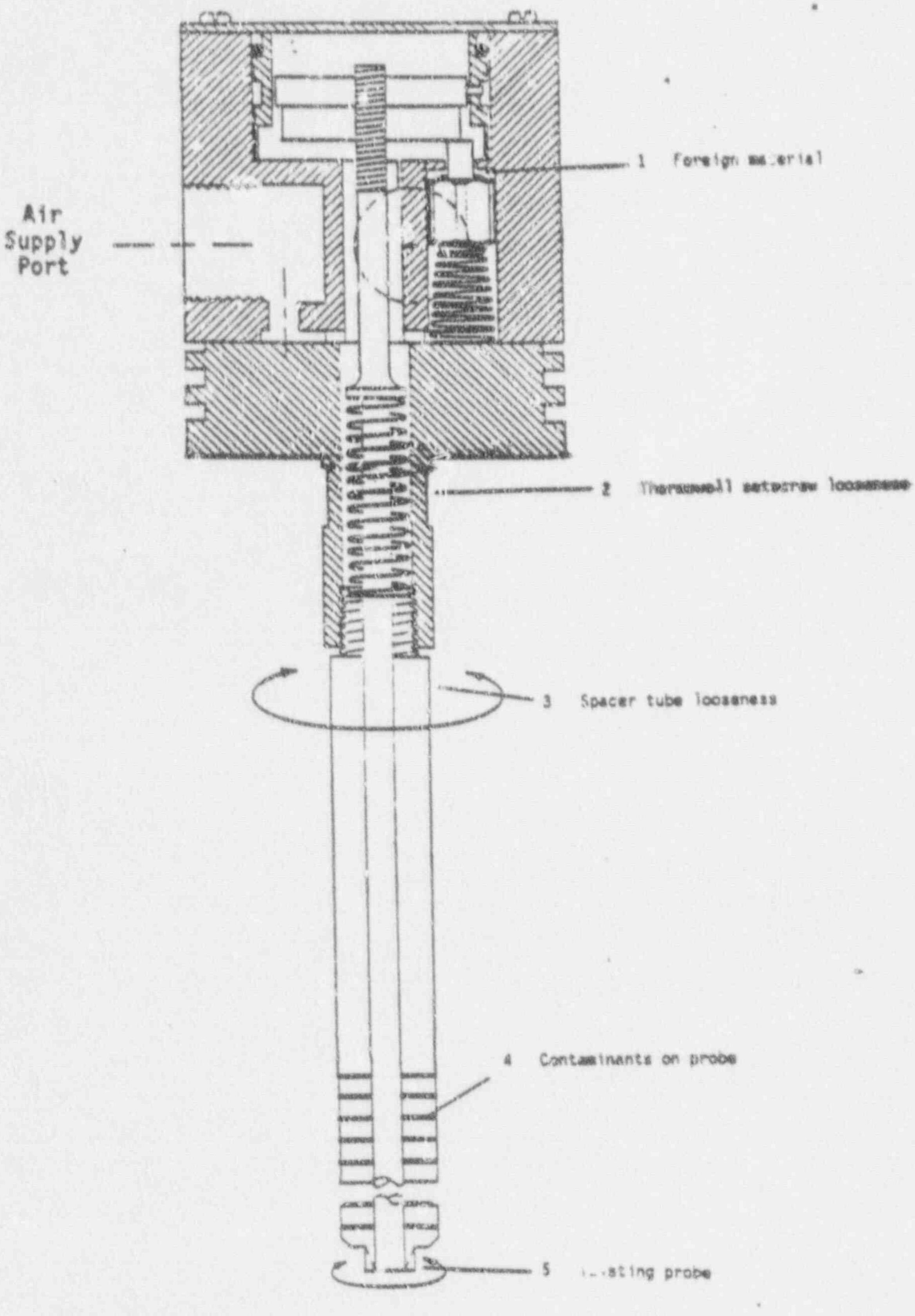

Figure 1. Schematic of a Calcon A3500 Temperature Sensor

DISTRIBUTION
Central file
SICB RF

Michael Waterman	8H3	SICB
Joseph Joyce	8H3	SICB
Scott Newberry	8H3	SICB
JMain		
Ashok Thadani	8E2	DST
Carl Berliner	8D22	OGCB
Charles E. Rossi	11E4	DOEA
Stewart W. Brown	14E21	PD12
Lester L. Kinter	11D23	PD41
Walter A. Paulson	13H15	PD42
Richard A. Becker	14B20	PC21
Kahtan N. Jabbour	9H3	PD23
Charles M. Trammell	13E16	PD5
Lawrence E. Kokajko	13E16	PD5
Timothy G. Colburn	13E21	PD33
Rajender Auluck	13H3	PDTV
Alexander Adams Jr.	11B20	PDNP
Melinda Malloy	12E4	PTSB
Timothy A. Reed	9H3	PD23
Steven B. Reynolds	13E16	PD5