BALTIMORE
GAS AND
ELECTRIC

1650 CALVERT CLIFFS PARKWAY • LUSBY, MARYLAND 20657-4702

GEORGE C. CREEL
VICE PRESIDENT
NUCLEAR ENERGY
(410) 260-4455

July 8, 1992

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Des

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Electrical Distribution System Functional Inspection, Combined Inspection Report Nos. 50-317/92-80 and 50-318/92-

REFERENCE: (a) Letter from Mr. M. W. Hodges (NRC) to Mr. G. C. Creel (BG&E), Electrical Distribution System Functional Inspection (EDSFI) of Calvert Cliffs Units 1 and 2, Combined Inspection Report Nos. 50-317/92-80 and 51-318/92-80, dated June 5, 1992

Gentlemen:

Reference (a) transmitted the Calvert Cliffs EDSFI Inspection Report and requested a 30 day response to three violations and twelve unresolved items. It also identified four issues requiring expedited review and resolution. This letter forwards our response to those four issues which correlate to Unresolved Items numbered 92-80-005, 92-80-006, 92-80-008, 92-80-009, 92-80-011, and 92-80-013.

As discussed with Mr. Bill Ruland of your staff, we intend to provide our response to the three violations on August 7, 1992 and the remainder of the unresolved items on September 8, 1992. If we are unable to provide all three violation responses by the intended date we will give prior notification and provide those responses which are available.

Should you have any further questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

GCC/EPW/bjd

Attachment

Cert No P046603346

IE01

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
P. R. Wilson, NRC
R. I. McLean, DNR
J. H. Walter, PSC

ATTACHMENT

BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Unresolved Item #1 (50-317/50-318 92-80-005) Adequacy of EDGs to Support Worst Case Accident Loads

NRC Concern

The team reviewed the EDG capabilities to perform its safety-related function following a design basis event. The EDGs are very heavily loaded and the team was concerned that limited margins are available. Specifically, the team found the following areas of concern:

- The reduced effectiveness of the turbo charger during the initial loading sequence has not been addressed.
- LOCA following a LOOP results in greater than 3150 kW load with the fuel rack stop set to limit the steady state output to maximum of 3250 kW.
- The simplified predictions of the EDG dynamic performance did not account for the above limitations.
- Voltage drop at step 4 in the SI simulation surveillance test is marginal under test conditions and would be worse under accident conditions.
- Resetting the EDG voltage regulator stability adjustment could result in the EDG becoming unstable.

The team requested BG&E to evaluate the capabilities of the EDGs to fulfill their safety function for all design basis events considering dynamic loading sequence, reduced turbo charger performance prior to engine warm-up, limiting operating boundary conditions (combustion air temperature, range of fuel oil characteristics, etc.) and the limitations of the fuel rack stop. This assessment should include the variations in engine speed, generator voltage, recovery time and fuel rack position accounting for all errors and drifts.

The team had no concerns with continued plant operation while BG&E continued its analyses. This issue remains unresolved pending BG&E performing: (i) analysis and/or testing to demonstrate the machine's ability to supply the accident loads without exceeding the 75% voltage dip FSAR limit with all sources of instrument drifts and errors, and (ii) further review of the impact on machine stability at 100% load.

Baltimore Gas & Electric Response

BG&E recognizes that the EDGs at Calvert Cliffs are heavily loaded. To address this concern as well as those identified above, BG&E has planned both short term and long term actions. Short term actions include conducting necessary calculations to demonstrate that the existing EDGs are capable of performing their design function. Long term actions involve the installation of new EDGs at CCNPP. BG&E plans to direct the majority of effort and resources toward the new EDG installation, which is currently in progress. We believe this strategy offers the most benefit in enhancing EDG capability at CCNPP.

Although the existing EDGs at CCNPP have limited margins, BG&E is confident the EDGs currently present no operability concerns. Extensive test data has been reviewed, load calculations which contain considerable conservatisms have been developed, and verification from the EDG vendor regarding EDG performance during various conditions has been received. These items support BG&E's conclusion. These items have been and are available for NRC review.

Short Term Actions

BG&E plans to evaluate the capability of the existing EDGs by reducing calculated load through a systems analysis of design basis accident emergency AC load requirements. To accomplish this, BG&E is in the process of completely revising calculation E-88-15, "EDG Accident Loading." The calculation will consider and/or incorporate:

- revised EDG loading based on updated drawings and DCNs,
- kVAR loading on the EDGs,
- system cable losses,
- CCNPP EOPs to verify agreement between calculational assumptions and
- required operator actions,
- potential for diversity to reduce EDG loads, and
- the effect of frequency variation on EDG loads.

A draft of E-88-15, Revision 1, is complete. Preliminary results indicate that in the first half-hour of a main steam line break (MSLB), large break loss-of-coolant accident (LOCA), and small-break LOCA, the anticipated accident loading is below the EDG continuous ratings of 2500 kW. Revision 1 to this calculation will undergo verification in accordance with the CCNPP Quality Assurance requirements. However, based on the preliminary results of this calculation, design margin remains available at the 2500 kW continuous rating and substantial margins are available at the 200 hour rating of 3000 kW.

Once the revision to this calculation has been completed, BG&E will address the scavenging air blower load/turbocharger performance for the first few minutes of EDG operation. The preliminary results of Revision 1 to E-88-15, showing reduced EDG loading from Revision 0, indicate that this will be of no concern. Similarly, BG&E will determine the need for further evaluation of the fuel rack stop limitations after the re-assessment of EDG loading has been finalized.

BG&E will complete the above activities by December 31, 1992.

Regarding the marginal voltage drop at step 4 in the SI simulation surveillance test, as outlined in the inspection report, BG&E has identified that: (i) voltage dips on the EDG output are primarily caused by the motor locked rotor current and not significantly increased by whether a motor delivers 50% or 100% of rated load, (ii) calculations shown as conservative through testing indicate that voltage will not fall below 75% of nominal, (iii) no equipment damage was noted during the past surveillance test failures with voltage dips below 75% of nominal, and (iv) a vendor engineer has provided written confirmation that regulator adjustments were proper and ought to improve voltage regulator performance.

BG&E has concluded that incorporating instrument drift and errors to demonstrate that EDG voltage dips will not fall below 75% of nominal voltage is not necessary. We believe the current procedures are adequate and consistent with standard industry practice. Considerations supporting this conclusion will be forwarded under future correspondence.

Long Term Actions

Long term actions are planned which will resolve the EDG loading concerns indicated above. These long term actions involve installation of two 5000 kW, Class 1E EDGs at CCNPP. The addition of the two new EDGs with the existing machines will result in the availability of a minimum of 17,500 kW of on-site emergency power to supply accident loads. Installation of the two new EDGs will also result in a realignment of the on-site emergency supplies to accident loads. The smaller existing 2500 kW machines will be dedicated to more lightly loaded buses while the new 5000 kW machines will be dedicated to the more heavily loaded buses. Installation of the two new machines will result in significant margins of machine rating versus anticipated accident loading for each EDG. The engineering design changes to install the new EDGs are in progress. Both EDGs are currently scheduled to be installed in refueling outages ending in 1995.

As part of the EDG addition, new analyses are being developed. These analyses will employ a master calculation concept using the CYME software to model the electrical auxiliary system. New load flow and short circuit calculations will be developed. Each EDG will be modeled for steady state and transient loading capability. These calculations coupled with test results will conclusively support the load carrying capability of the EDGs at CCNPP.

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BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Unresolved Item # 2 (50-317/50-318 92-80-006) Adequacy of degraded grid relay setpoints and load flow study

NRC Concern

The inspection team review raised a concern that, in their view, BG&E had not determined the adequacy of plant voltages for the degraded grid relay range between reset and minimum dropout setpoint values. This concern raised several questions by the inspection team during the EDSFI and resulted in seven items to review and resolve by Baltimore Gas & Electric (BG&E). These are:

- performing a voltage regulation study for the voltage range between nominal reset and minimum dropout of the degraded grid relays and determining the adequacy of the degraded bus relay setpoint,
- revising the calculations to reflect higher conductor operating temperature, accounting for cable impedances,
- establishing adequacy of starting and running voltages for charging pump 13 under worst case conditions,
- providing technical justification for 460 V loads, powered from bus(es) 11A and B,
- establishing adequate starting and running voltages for panel 1P14 loads,
- establishing MCC 114R contactors thermal capability during degraded voltage conditions, and
- analyzing motor starting and running capabilities based on motor purchase specifications and testing.

Baltimore Gas and Electric's response to resolve each of these items is provided separately below.

Background Information

Second level undervoltage protection at CCNPP was established on two bases; (i) the time delay for which the plant could be subjected to degraded grid conditions and (ii) the setpoints of the minimum voltage which the off-site supply would be allowed to degrade before initiating timing of the protective relays.

The degraded grid undervoltage relays monitor system voltage at the 4.16 kV safety related buses. The basis of the dropout setting of these relays was determined by establishing the upper and lower bounds required by plant operation and licensing requirements. The lower bound was based on the minimum pickup voltage of 85% of nominal MCC bus voltage (determined by test) for 120V contactors. The upper bound was constrained by the acceleration time of the reactor coolant pump (RCP) motors. These pump motors have an acceleration time of greater than 10 seconds. The 4.16 kV bus voltage was analyzed to be 89% of nominal during this acceleration time. Therefore, the degraded grid relays was set to dropout above the lower limit of 85% of 480V MCC bus nominal voltage and below the voltage dip of 89% of 4.16 kV bus nominal voltage caused by the RCP start. The reset setting of the degraded grid relays was established by the 1% bandwidth limit of the relay. The minimum switchyard voltage of 97% nominal (485 kV) was then established to be at a value

which would allow the 4.16 kV bus voltage to recover above the reset setpoint of the degraded grid relay after a plant trip followed by an ESFAS.

To determine the time delay, an upper and lower limit was also considered. The upper time delay limit was considered to be constrained by CCNPP's FSAR requirement that diesel generators be available to accept load within 10 seconds of a signal to start. Further, consideration was given of the potential for fuses to open on the 120V side of MCC starters as a result of anticipated inrush currents during the timing of the degraded grid relays.

Regarding the lower time delay limit, several issues were reviewed, including the starting of the safety features components when supplied by the offsite supply. Starting times were considered to be maximum of five seconds acceleration for large motors including the condensate booster pump.

The overall time delay of the degraded grid relays as a result of the above considerations was determined to be eight seconds. The setpoint of the degraded grid relays was evaluated to be 103.9 volts for dropout of the relays. This corresponds to a voltage at the 4.16 kV safety related bus of 3,629 volts.

a) **performing a voltage regulation study for the voltage range between nominal reset and minimum dropout of the degraded grid relays and determining the adequacy of the degraded bus relay setpoint**

NRC Concern

The setpoints of the second level undervoltage protection relays are (i) dropout - 3628 25V and (ii) reset - 3668V. Currently there is not an analysis that will (i) calculate the downstream terminal voltages at Class 1E components when the voltage level at the safety related 4.16 kV buses is between the minimum dropout and reset setpoints (3603V - 3668V) of the second level undervoltage protection relays and (ii) verify the adequacy of the relay setpoints.

Baltimore Gas & Electric Response

To ensure the reliability of the Class 1E system BG&E plans to make several enhancements to the preferred offsite supply to the Class 1E buses. These include the addition of a new offsite supply to CCNPP; the Chalk Point Line and addition of voltage regulating equipment which may include auto-load tap changing transformers, static var compensators, voltage regulators and/or capacitor banks. An evaluation of the voltage regulation equipment to be used will be completed by August 31, 1992.

The enhancements to the offsite supply will require a number of studies and analyses to be developed. These analyses will include new load flow/voltage regulation studies. In the development of these new load flow/voltage regulation studies, BG&E will perform a study which determines the terminal voltage of the Class 1E components downstream of the Class 1E 4.16 kV buses when the voltage levels on these buses are between the dropout and reset values of the second level undervoltage protection relays. This study will verify the adequacy of the existing setpoints or establish new setpoints of the second level undervoltage relays by identifying the minimum voltage allowable at the Class 1E 4.16 kV buses. This study will be complete December 31, 1993.

b) **revising the calculations to reflect higher conductor operating temperature, accounting for cable impedances**

NRC Concern

The BG&E calculation which determines cable impedances for use in load flow studies base the impedance of power cables on a conductor operating temperature of 75 C. These cables were procured for continued operation at the conductor temperature of 90 C. Use of 75 C versus the temperature rating of the cables will result in lower impedance values used in load flow calculation and may yield non conservative results.

The current carrying capacity of cables routed in cable trays and metallic conduit can be reduced by: (i) heat transfer of cables routed within the same raceway and (ii) increased impedance of the cables resulting from the magnetic field effects of metallic raceways and mutual coupling of cables routed within the same raceways. The current carrying capability is generally derated to account for these affects. Operation of components at current levels close to or at the derated level of a cable will result in increased conductor temperatures, increased voltage drop through the cable and further reduced current capability of the cable.

Baltimore Gas & Electric Response

The existing load flow studies are based on the impedances of cables operating at a conductor temperature of 75°C. The approach of basing cable impedances with all cables operating at 75°C was considered conservative. To verify whether this approach is conservative, BG&E developed new load flows based on impedances of cables at their anticipated conductor operating temperature.

To run these new load flows, a preliminary calculation that determines the anticipated conductor operating temperatures of cables used in the load flows was developed. The impedances of these cables were adjusted to reflect their anticipated impedance at the calculated temperatures and new load flows were developed based on the new cable impedances. The results of the recalculated load flows were compared with the results of the existing load flow calculation based on 75°C cable temperatures. The calculation based on 75°C cable temperatures resulted in lower terminal voltages at the components evaluated.

BG&E, therefore, concludes that the results of the load flows based on identification of cable impedances with all conductors operating at 75°C is an acceptable approach.

c) **establishing adequacy of starting and running voltages for charging pump 13 under worst case conditions**

NRC Concern

The specified starting and running voltages of the Charging Pump 13 motor are 75% and 90% respectively of motor rated voltage. This is equivalent to a minimum allowable voltage at the motor terminals of 345V to start and 414V for continued operation of the motor. A BG&E calculation identified that with the voltage at the 4.16 kV emergency bus at the reset setpoint of the degraded grid relays, the Charging Pump motor terminal voltage to accelerate the driven equipment could be as low as 65.2% of rated and the running voltage at 86.3% of rated.

With the anticipated available voltage below the minimum specified, there is a concern over the motor's ability to accelerate its driven equipment and sustain continued operation once fully accelerated.

Baltimore Gas & Electric Response

There are two areas of NRC concern regarding this one item; (i) the capability of the motor to accelerate its driven equipment with 65.2% of motor rated voltage available at its terminals and (ii) the capability of the motor to sustain adequate operation of its driven equipment with 86.3% of motor rated voltage available at its terminals.

With regard to the capability of the motor to accelerate its driven equipment at reduced terminal voltage (65.2% of rated), BG&E developed a plot of the torque required by the driver equipment and the speed torque curve of the motor. The speed torque curve of the motor was plotted with a fixed voltage of 68.1% of motor rated voltage at the motor terminals throughout the motors acceleration. Review of the BG&E calculation which anticipates 65.2% motor rated voltage available to start the motor identified that the cable lengths used in the calculation were overly conservative. With use of actual cable lengths the anticipated value of motor terminal voltage available to start the motor is 68.1%.

A comparison of the load torque curve versus the motor speed torque curve demonstrates that the motor will develop sufficient torque to accelerate its driven equipment at the reduced voltage. A copy of the plot is available for the NRC's review.

With regard to the capability of the motor to sustain adequate operation of its driven equipment with 86.3% of motor rated voltage available at its terminals, the load factor of this motor is 74%. The current drawn by this motor with it operating at this load factor and with 86.3% of motor rated voltage available at its terminals is less than if the motor was operating at rated nameplate horsepower and voltage. Therefore, the motor windings will be operating within the designed temperature limits of the machine and will not experience thermal degradation of the stator windings with 86.3% motor rated voltage at its terminals. Further, the running torque developed by the motor with 86.3% motor rated voltage at its terminals is more than 74% of the running torque with the motor operating at nameplate voltage. There is reasonable assurance that the motor will adequately sustain continuous operation of its driven equipment without thermal degradation of its stator windings and ultimate failure.

However, the enhancements to the offsite supply for the addition of the Chalk Point line and the new voltage regulating equipment noted above, will require a number of studies and analyses to be developed. These analyses will include new load flow/voltage regulation studies. In the development of these new load flow/voltage regulation studies, the running voltage available at the terminals of the Charging Pump 13 motor will be reassessed. If this reassessment identifies a running motor terminal voltage 414V, BG&E will develop a study that will model operation of the motor at the reduced voltage fixed at its terminals to verify the motor will not fail. This study will be complete December 31, 1993.

d) **providing technical justification for 460 V loads, powered from bus(es) 11A and B**

NRC Concern

Upon an ESFAS in unit 1 and degraded voltage conditions, a BG&E calculation identifies that the running terminal voltage of 460V motors supplied by buses 11A & 11B will be below 90% of motor rated voltage. The specified minimum running voltage of these motors is 90% of rated nameplate value, or 414V. Sustained operation of these motors at less than the minimum specified value may result in increased heating of the motor stator windings and eventual failure of the motor to operate.

Baltimore Gas & Electric Response

As described in the EDSFI inspection report, existing procedural controls and alarms at the Electric System Operation Department Energy Center ensure that voltage is maintained well above 90% of nominal. Moreover, the addition of the Chalk Point line and enhancements to the offsite supply will result in improved running terminal voltages of the motors supplied by buses 11A and 11 B and may result in a reassessment of the setpoint of the degraded grid relays. In the development of new voltage regulation/load flow studies resulting from this line addition and enhancements to the offsite supply, the running terminal voltages of safety related motors will be reassessed. If the setpoint of the degraded grid relays is raised to a value that results in 90% running terminals voltages at the motors of buses 11A and 11B, then BG&E will consider the issue resolved..

If the setpoint of the degraded grid relays is not raised to a valve which results in ≥ 90% running voltage, then BG&E will obtain vendor data to support continued operation of motor loads supplied by buses 11A and 11B at motor terminal voltages between 80% and 90%. For those motors where vendor data may not be available BG&E will calculate the running torque of the motors, at reduced terminal voltage, supplied by buses 11A &11B whose anticipated running terminal voltage is < 90% of motor rated. The calculated running torque values will be compared to breakdown torque values for typical motors contained in NEMA publication MG1, part 12. Where the values of running torque are less than the NEMA MG1 values of breakdown torque, the motor will be considered adequate to operate its driven equipment at the reduced motor terminal voltage. Where the values of running torque are greater than the NEMA MG1 values of breakdown torque, the motor will be evaluated and corrective actions taken if necessary. Included in this evaluation will be a comparison of anticipated motor running terminal voltage with the addition of the Chalk Point line and enhancements to the offsite supply and the resulting running torque values at the anticipated improved terminal voltages. This evaluation will be complete December 31, 1993.

e) **establishing adequate starting and running voltages for panel 1P14 loads**

NRC Concern

Under worst case starting conditions during an ESFAS, a BG&E calculation indicates the terminal voltage available at safety related loads supplied by distribution panel 1P14 will range from 84.7 to 87.5V. There is no acceptance criteria for the minimum acceptable terminal voltage of these loads or justification for the condition provided within the calculation. The condition is considered acceptable based on; these loads will suffer a

complete loss of voltage when the emergency diesel generators are started on an undervoltage.

Baltimore Gas & Electric Response

The design and licensing basis of CCNPP allows that on a loss of offsite power, or degraded grid conditions, to the Class 1E emergency buses, the buses separate from the grid, load shed, the emergency diesel generators (EDGs) are started, come up to rated voltage and speed, and emergency loads are resequenced on the bus. The time frame the buses are tripped and the EDGs begin to sequence loads is a period of 15 seconds. During this period the loads of panel 1P14 are without voltage applied to their terminals. Therefore, the CCNPP licensing basis does allow for these loads to experience a loss of voltage transient during emergency shutdown conditions.

The conditions postulated in the BG&E calculation are somewhat less severe; these loads will experience a transient during the simultaneous starting of all ESFAS loads. After the transient, the terminal voltage of the panel 1P14 loads will recover to above 102V. The postulated condition of the calculation is very conservative with the voltage at the 4.16 kV bus at the reset value of the degraded grid relays (3668V) followed by all ESFAS loads starting simultaneously. Therefore, since it is acceptable to have a complete loss of voltage to these loads for a period of 15 seconds and then re-energize them, it is also acceptable to expose them to a transient (70.5% of rated voltage) at the beginning of an ESFAS that should result in a rapid recovery of terminal voltage to above 85% of rated values when large motors have completed acceleration of their driven equipment.

The components in question supplied by panel 1P14 are:

Switchgear Room AC Control Circuit
Core Exit Thermocouples Transducer
Reactor Vessel Level Monitoring System
H2 Analyzer
Wide Range Effluent Monitoring System

Review of the electrical schematics of each of these components identifies a number of relays, indicator lights, a few solenoids and panel heaters, and solid state components will be exposed to the transient. Coil components, such as auxiliary relays and solenoids, generally dropout on a voltage lower than the indicated transient. For example, vendor data identifies that the contactor coils supplied with the CCNPP MCC starters will remain energized with 66V applied to their terminals. Solid state components can generally withstand minimal voltage dips of the range anticipated in the calculation of short duration without effect to their circuits. However, BG&E will verify with the supplier of the systems which contain solid state components that they can withstand the postulated transient. We expect this to be complete December 31, 1992.

The addition of the Chalk Point line and enhancements to the offsite supply will result in increased voltages at the terminals of the panel 1P14 loads. BG&E will reassess the adequacy of the panel 1P14 loads upon the new voltage regulation/load flow studies that are developed.

f) **establishing MCC 114R contactors thermal capability during degraded voltage conditions**

NRC Concern

During starting of all ESFAS loads the voltage available at MCC 114R may result in control circuit contactors not picking up until the voltage recovers to a sufficient value. A BG&E calculation postulated that these contactors would continue to draw inrush current until the voltage recovers. The estimated duration of this condition is four seconds - the time frame estimated for acceleration of motor loads. With full inrush currents applied to the contactors for the postulated four seconds, will they suffer damage from heating effects and fail?

Baltimore Gas & Electric Response

In our view it is highly unlikely that the contactors in question will fail. The manufacturer of the components, Telemechanique, does not have any data regarding the thermal capability of the contactors under inrush conditions. Where there is a lack of data available, BG&E researched industry standards to find similar components on which there may be industry data available. Dry type transformers were considered a similar component in that both are coil type devices. The calculation which postulated the condition compared the thermal capability of dry-type transformers identified in IEEE/ANSI standards to the calculated I2t value of the contactor.

To verify their capability, BG&E will perform tests on the size contactors used in MCC 114R to determine if they will pick up at the postulated voltage at the bus. If these contactors pick up at the postulated voltage, the tests will be considered complete. If there are size contactors which do not pick up at the postulated voltage, BG&E will continue the tests by applying the anticipated inrush current to the contactors in question for a period of four seconds and determine if there are any failures.

Upon failure of a size contactor to pick up at the postulated voltage and withstand the anticipated inrush current for four seconds without suffering damage, BG&E will take appropriate measures. These tasks will be completed by December 31, 1992.

g) **analyzing motor starting and running capabilities based on motor purchase specifications and testing.**

NRC Concern

The minimum acceptable starting motor terminal voltage contained in BG&E calculations are 75% of motor rated voltage for 480V load center supplied motors and 70% of motor rated voltage for 480V MCC supplied motors. Procurement specifications for a control room air conditioning compressor and a containment spray pump motor did not contain requirements for 75% starting capability. Starting of MCC supplied motors at 70% of rated voltage is based on; (i) these motors are typical NEMA design B and (ii) at NEMA MG1 typical values and requirements, the motors would develop sufficient torque to accelerate their driven equipment with 70% of motor rated voltage at the motor terminals.

Where 75% starting capability of motors is a non-standard requirement, the motor suppliers may have supplied standard motors unless procurement specifications clearly identified this requirement. If the motors are standard capability motors, then reduced voltage at their terminals may result in prolonged acceleration times, increased inrush currents, and voltage

drops currently not considered in BG&E calculations and may result in the dropout of the degraded grid relays.

Baltimore Gas & Electric Response

Sufficient documentation exists to verify the starting capability of motors supplied by 480V load centers with 75% of motor rated voltage available at the motor terminals. This documentation is in the form of vendor supplied data and by correspondence with Bechtel Power Corporation that is attached to BG&E calculation E-90-28, revision 0. This documentation is available for your review.

With regard to 460V motors supplied by 480V MCCs, the basis to conclude that these motors have the capability to start with 70% motor rated voltage available at their terminals is as follows:

> These motors are typically NEMA Design B class motors with the exception of valve motor operators to stroke motor operated valves. Using values of torque contained in NEMA, part 12, BG&E plotted the speed-torque curves of these typical motors with 70% motor rated voltage at the motor terminals versus the load torque curve of a typical centrifugal motor load. This plot clearly demonstrated that the motors would develop sufficient torque to accelerate their driven equipment with 70% of motor rated voltage at its terminals.
>
> This approach was questioned by the inspection team as being general and not specific to the CCNPP installed motors.

In the view of BG&E there is reasonable assurance that these motors are capable of starting with 70% motor rated voltage available at their terminals. However, the enhancements to the offsite supply for the addition of the Chalk Point line and the new voltage regulating equipment noted above, will require a number of studies and analyses to be developed. These analyses will include new load flow/voltage regulation studies. In the development of these new load flow/voltage regulation studies, the voltages available at the terminals of the Class 1E buses and safety related motors will be reassessed. If this reassessment identifies terminal voltages of MCC supplied motors < 75% of motor rated voltage, BG&E will take appropriate corrective action.

The new load flow/voltage regulation studies will be complete December 31, 1993.

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BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Unresolved Item #4 (50-317/50-318 92-80-008) EDG Loading Calculation

NRC Concern

During the review of calculation E-88-15 dated November 3, 1988, "Diesel Generator Accident Loading," the inspection team noted a number of discrepancies:

- Where no manufacturer s data was available, an efficiency of 0.90 was assumed for 460 V motors supplied by motor control centers. The team considered this to be a non-conservative assumption since efficiencies for these motors typically vary from 0.80 to 0.90. Using a more conservative efficiency value results in a higher calculated EDG load.

- Cable losses were not considered in this calculation.

- The power requirements for the salt water pumps did not account for actual system flow rates. In addition, the power required to drive the component cooling water pumps was based on both parallel pumps running rather than one pump operating. In each case, the inspection team identified that the actual power demand was higher than that used in calculation E-88-15.

The inspection team estimated that the above items would contribute an additional 70 kW load in the loading calculation for the worst case event. Therefore, the EDGs may only have limited margin based on this sampling review. This item remains unresolved pending BG&E finalizing the maximum loading on the EDG, updating the diesel generator loading calculation and revising any plant emergency operating procedures as necessary.

Baltimore Gas & Electric Response

BG&E is completely revising calculation E-88-15, EDG Accident Loading. As part the revision process, BG&E will assess maximum EDG loading including the concerns noted above. Based on the preliminary results of this calculation, design margin remains available at the 2500 kW continuous rating and substantial margins are available at the 200 hour rating of 3000 kW. Documentation such as the FSAR, emergency operating procedures, and associated calculations will be updated appropriately. E-88-15, Revision 1, will be completed by December 31, 1992.

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BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Unresolved Item #5 (50-317/50-318 92-80-009) HVAC for EDS Equipment

NRC Concern

The EDSFI team identified the following concerns related to switchgear room HVAC:

(1) Although two parallel trains of switchgear room HVAC were provided, the HVAC system is susceptible to the following common mode failures because of common supply and return ducts.

- A fire in the 45' switchgear room could destroy one train of switchgear and isolate ventilation to the 27' switchgear room, impairing the second electrical train.
- A missile generated by the motor generator set in the 45' room could destroy safety-related switchgear in the 45' room and the common ventilation ducting.
- Fire in the equipment room with the air handlers could impact air flow to both switchgear rooms.
- Tornado missiles could impact switchgear room HVAC through damage to air handling units or rooftop condenser units.
- Collapse of the common ducting could disable both trains of HVAC, impairing both trains of switchgear.
- Destruction by fire of air-operated dampers in the 45' room could lead to a failure of the fail-open dampers in the 27' room.

(2) The CCNPP Appendix R (Fire Protection) analysis does not appear to address the above potential common mode failures.

(3) Switchgear room temperature calculations do not appear to address total loss of ventilation.

(4) System operating instructions do not assure initial conditions of the temperature analyses are satisfied nor do they provide instructions for long term cooling under various postulated conditions.

BG&E committed to review the analysis and procedures to ensure that an adequate operating environment is provided for at least one train of switchgear for all scenarios affecting the common HVAC system. This issue remains unresolved pending BG&E: (i) completing an analysis that addresses all the accident scenarios including total loss of ventilation air flow, (ii) modifying the operating procedures to ensure the assumed initial conditions required to support the calculated thermal transients, (iii) amending the operating procedures to ensure that adequate equipment and instructions are provided to reliably establish long term cooling, and (iv) resolving the Appendix R issues related to the HVAC system.

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BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Baltimore Gas & Electric Response

BG&E performed an Operability Determination of the switchgear room HVAC which concluded that the system is operable. This response is based on elements contained in the engineering evaluation supporting the Operability Determination. The Operability Determination is available for NRC review. A response to each of the concerns is presented below.

(1) Total Loss of Ventilation

BG&E is in the process of implementing implemented procedures to take immediate actions on increasing temperature in both switchgear rooms, or on increasing temperature in one switchgear room with indication of total switchgear ventilation failure. These actions are:

- at 101°F, operators will be dispatched to verify emergency ventilation is staged for the affected switchgear room.

- at 104°F, and if normal ventilation cannot be restored, operators will begin shutdown of the Unit and establish emergency ventilation as quickly as possible. Switchgear loads will be reduced consistent with the shutdown.

BG&E has concluded that the above actions will ensure the switchgear room temperature is maintained below 150°F. Details regarding these actions are contained in the referenced Operability Determination. The applicable procedures will be fully implemented by August 21, 1992. The equipment necessary to carry out these actions, however, has been purchased, is staged and is available for use.

In addition to the measures being implemented to address switchgear HVAC common mode failures, BG&E will complete necessary analysis or tests with specific recommendations for improvement by December 31, 1994. BG&E's assessment and necessary actions regarding each of the above common mode failures is presented below.

- A fire in the 45' switchgear room could destroy one train of switchgear and isolate ventilation to the 27' switchgear room, impairing the second electrical train.

  The 45' and 27' switchgear rooms are equipped with a halon fire suppression system. The halon system is actuated by smoke detection signals. Smoke detection and high temperature signals will isolate the air operated isolation (smoke) dampers for the affected room and will alert control room operators to the problem. Normal ventilation will continue to the unaffected room.

  At the same time, the fire brigade will immediately respond to the fire. The fire will be quickly extinguished because (i) halon is automatically initiated and (ii) switchgear rooms contain limited amounts of combustible material. Consequently, the fire most likely will not have the heat capacity to damage the common duct. The fire brigade will be directed to restore ventilation to the room as soon as the fire is extinguished. If the fire fighting is longer than 10 minutes in duration, the ventilation system will be shutdown per emergency response procedures, enabling the fire dampers within the ventilation ducts to close if the temperature is high enough to melt the fusible links holding them open. This action will eliminate normal ventilation to both switchgear rooms until the fire was extinguished. At this time the emergency fans will be started,

as discussed above, and will provide ventilation in the switchgear room unaffected by the fire.

- A missile generated by the motor generator set in the 45' room could destroy safety-related switchgear in the 45' room and the common ventilation ducting.

  A CEDM motor-generator with identical flywheel design and virtually identical motor rating was analyzed and tested by Combustion Engineering for the ability of the flywheel to operate safely at 110% of rated speed. The flywheel was successfully tested at 150% of rated speed (2700 rpm). The bursting speed was calculated to be 4330 rpm (240% of rated speed), providing a significant margin above the operating speed. Based on the above information, missiles generated by the CEDM motor-generator set is not a credible event. However, if a missile did damage the ducting, the emergency ventilation discussed above would be implemented.

- Fire in the equipment room with the air handlers could impact air flow to both switchgear rooms.

  The two trains of air handlers for the switchgear room ventilation are located in a room on the 69' elevation of the Auxiliary building. A fire in this room could potentially destroy both trains of air handlers, resulting in a total loss of switchgear room ventilation. This event is the bounding scenario of the common mode failures; the emergency ventilation actions discussed above would be implemented.

- Tornado missiles could impact switchgear room HVAC through damage to air handling units or rooftop condenser units.

  If a tornado missile did damage the air handling units or rooftop condenser units, the emergency ventilation discussed above would be implemented.

- Collapse of the common ducting could disable both trains of HVAC, impairing both trains of switchgear.

  The pressure drop caused by a tornado (approximately 3 psi) would be the only failure mechanism to cause collapse of a duct. A pressure differential could only be developed between atmosphere and a sealed area. However, the switchgear rooms are not sealed; the ventilation system's supply and exhaust are open to atmosphere and the switchgear rooms. Any change in atmospheric pressure would be transmitted to the switchgear rooms, which would eliminate the pressure drop across the duct. If the duct should experience some damage, the chances of ventilation being completely cut off are minimal. In spite of this, should ventilation be lost due to complete duct collapse, the emergency ventilation actions described above would be initiated.

- Destruction by fire of air-operated dampers in the 45' room could lead to a failure of the fail-open dampers in the 27' room.

  There is an air operated isolation (smoke) damper on each ventilation supply line and each exhaust line for the 45' and 27' switchgear rooms. The air operated isolation (smoke) dampers are air to close and fail open. Air supplies for the 45' and the 27' room smoke dampers are provided by two independent solenoid valves. A fire in the 45' room damaging the air operated dampers would not affect the dampers in the 27' room. But in the unlikely event this did happen, the air operated isolation (smoke) dampers in the 27' room would fail open which is conservative with respect to room ventilation. Additionally, the fire dampers inside the duct would provide for fire isolation and emergency ventilation could be utilized.

(2) Appendix R Analysis and HVAC

As noted by the EDSFI team, the CCNPP Fire Protection (Appendix R) Analysis did not address the above common-mode failures associated with switchgear room HVAC. As discussed above, measures are being put in place to address these concerns. Additionally, a thorough review of fire protection issues associated with HVAC with be undertaken to verify the adequacy of measures taken and consider possible enhancements. BG&E will complete this review and update the Appendix R analysis by December 31, 1994.

(3) Switchgear Room Temperature Calculations

Switchgear room temperature calculations did not address total loss of air conditioning because the HVAC design (including single active failure) provides at least one fan in operation at all times.

Although BG&E Calculation M-90-33B, "Heatup of SW Gear Rooms at EL. 27' and 45',' assumes one fan operating in the recirculation mode during the transient, the total loss of ventilation has a minor effect on the temperature rise. The calculation states that even if ventilation were not available, the actual higher temperatures would tend toward the top of the rooms and near the higher heat sources (i.e., non-safety-related MG sets), away from the more critical safety-related components. Operation of a fan in recirculation during the transient prevents stratification in the room and does not provide any significant benefit. Therefore, the results of the calculations assuming one fan operating in recirculation would be consistent with what is expected with no ventilation. In addition, analytical techniques to determine temperature rise, particularly with no ventilation flow, are marginal and tend to be highly conservative. For this reason, as part of its review of HVAC common mode failures, BG&E is evaluating the benefits of performing a test to actually measure switchgear temperature rise as a function of loads, with no ventilation.

(4) Procedures do not Address Concerns

Appropriate procedures are being revised to direct the actions discussed above under "Total Loss of Ventilation" and in the referenced Operability Determination with regard to operator actions on increasing temperature in the switchgear rooms and emergency ventilation. These actions will ensure calculated thermal transient initial conditions are maintained and reliable long-term cooling is provided to the switchgear rooms.

ATTACHMENT

BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Unresolved Item #7 (50-317/50-318 92-80-011) Adequacy of Swing Diesel Operation

NRC Concern

On an undervoltage condition, EDG 12 (the swing EDG) receives an automatic start signal but does not automatically align itself to its associated bus in either unit. As a result, EDG 12 will operate unloaded without service water cooling and will eventually trip on high jacket water temperature unless an operator manually loads the diesel prior to the trip. This may result in:

- In the event of a LOOP with a LOCA, the plant not affected by the LOCA event could experience a temporary station blackout if it also experienced a single failure of the only available EDG.

- In the event of a LOOP without a LOCA, EDG 12 could automatically shutdown on high temperature or be damaged by the lack of cooling water. In this case, a delayed LOCA affecting either unit could result in that unit being vulnerable to a single component failure.

The operation of EDG 12 without cooling water and the realignment of the swing diesel following a loss of one other diesel remain unresolved items pending a more thorough review of the cooling requirements and the establishment of adequate procedures to ensure the availability of the vital power source.

Baltimore Gas & Electric Response

An Operability Determination was prepared on May 29, 1992, which demonstrates that EDG 12 is operable and that the design is in concert with the plant licensing basis. The Operability Determination is available for NRC review. Our design sequence (starting EDG 12 but not loading it unless EDG 11 or 21 failed) optimizes the automatic response to our design basis event, which is a LOCA with a single failure. The postulated concern about non-availability of EDG 12 to compensate for a later failure of EDG 11 or 21 without operator action is outside our licensing basis. Nonetheless, we have currently addressed this scenario through operator guidance and are considering several options to enhance EDG 12 availability.

BG&E has taken a number of interim actions to address concerns associated with the swing diesel. The shift turnover information sheet now directs operator action to connect EDG 12 to the bus within 1 - 5 minutes of a LOOP event. Additionally, BG&E has directed that following operation of EDG 12 until it has sufficiently cooled, operations personnel either: a) declare EDG 12 inoperable, or b) station an operator at the Electrical Control Panels to immediately close the EDG 12 input breaker following a LOOP event. This guidance is now formally implemented in Operating Instruction No. 21.

BG&E currently estimates that the engine could operate at no load for approximately 10 minutes before automatically shutting down on high jacket water temperature at 200°F. BG&E has requested that Colt Industries, the EDG vendor, evaluate the time that a hot and cold EDG can idle without service water cooling and to determine the minimum amount of service water cooling required to permit an EDG to idle indefinitely.

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BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

BG&E is currently evaluating additional short term corrective actions to enhance EDG reliability. These include hardware modifications and procedure changes. Currently, two possible modifications which would enhance the reliability of EDG 12 are being evaluated; (i) remove the undervoltage (U/V) start associated with EDG 12, or (ii) modify the Service Water System to supply sufficient pressure to EDG 12 from either the 11 or 22 SRW subsystems. The revision of existing procedures, in addition to the administrative controls already in place, have also been considered; (i) revise EOP-0 to require EDG 12 output breaker to be closed, and (ii) revise EOP-0 to shutdown EDG 12. Additional options are being investigated. BG&E will complete an evaluation of the alternative short term actions with recommendations by September 30, 1992.

Regarding long term corrective actions, CCNPP has committed to installing two 5000 kW, Class 1E EDGs at CCNPP. Upon completion of this modification, each 4 kV emergency bus will have one diesel generator dedicated to it. The smaller existing 2500 kW machines will be dedicated to more lightly loaded buses while the new 5000 kW machines will be dedicated to the more heavily loaded buses. EDG 12 will be utilized as a spare diesel generator. Additionally, the service water piping to EDG 12 will be modified to permit EDG 12 to be aligned to any of the four service water subsystems.

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BG&E RESPONSE TO CCNPP NRC INSPECTION REPORT

Unresolved Item #9 (50-317/50-318 92-80-013) Procedures to Address Battery Room Cold Temperature

NRC Concern

The EDSFI team expressed concern that upon failure of the battery room heater, battery electrolyte temperature could fall to unacceptable levels in a time frame shorter than that existing between successive operator checks. Failure of a battery room heater is not indicated in the control room. BG&E had created facility change request FCR 89-62, "Battery Room Ventilation System," in 1990 which provides the inclusion of temperature monitoring switches in the battery rooms, with remote annunciation in the control room.

However, until this change is implemented, battery room temperatures could, in the event of the failure of heaters, fall below the value assumed in the battery sizing calculation (69°F) without the operating staff becoming aware of the condition. The battery rooms are visited routinely at the beginning of a twelve-hour shift. There is no schedule for re-visiting the rooms during the shift. The time between visits could extend up to twelve hours. There is no procedure for handling the event described above. The licensee agreed to provide operators with the necessary procedures. This item remains unresolved pending the licensee establishing adequate measures to cope with this event.

Baltimore Gas & Electric Response

FCR 89-62, "Battery Room Ventilation System," was initiated to provide temperature monitoring for the battery rooms with remote annunciation in the control room. BG&E will complete the installation of FCR 89-62 by December 31, 1994. Until this FCR is completed, operator logs have been revised to check ambient temperature in each battery room every 6 hours.

BG&E will develop procedures to direct corrective actions to maintain a minimum temperature of 69°F. This action will be complete by December 31, 1992.