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SUBJECT: Forwards supplemental response to IE Bulletin 79-27, "Loss of Non-Class 1E I&C Power Sys Bus During Operations."

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January 28, 1993

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
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Subject: Oconee Nuclear Station  
Docket Nos. 50-269, -270, -287  
IE Bulletin 79-27, Supplemental Response

By letter dated March 7, 1980, the response to IE Bulletin 79-27, "Loss of Non-Class 1E I&C Power System Bus During Operation" was provided for Oconee Nuclear Station. Subsequently, planned corrective actions associated with LER 270/92-04 included the assessment of the Keowee Hydro Station auxiliary power systems and the 230kV switchyard 125VDC power system in accordance with IE Bulletin 79-27. Please find attached the supplemental response to IE Bulletin 79-27.

Very Truly Yours,

  
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## ATTACHMENT

### OCONEE NUCLEAR STATION Supplemental Response to IE Bulletin 79-27 for Keowee Hydro Station and Oconee 230KV Switchyard

On March 7, 1980, Duke Power responded to NRC IE Bulletin 79-27, dated November 30, 1979, regarding Loss of Non-class 1E Instrumentation and Control Power System Bus During Operation. The review included all plant instrumentation and control systems that were considered to be necessary to be operable to bring an Oconee Nuclear Unit to cold shutdown. This supplemental response evaluates the Keowee Hydro Station and Oconee 230KV Switchyard instrumentation and control systems in accordance with IE Bulletin 79-27.

#### Question 1

Review the Class 1E and Non-class 1E buses supplying power to safety and non-safety related instrumentation and control systems which could affect the ability to achieve a cold shutdown condition using existing procedures or procedures developed under item 2 below. For each bus:

- a) Identify and review the alarm and/or indication provided in the control room to alert the operator to the loss of power to the bus.
- b) Identify the instrument and control system loads connected to the bus and evaluate the effects of loss of power to these loads including the ability to achieve a cold shutdown condition.
- c) Describe any proposed design modifications resulting from these reviews and evaluations, and your proposed schedule for implementing those modifications.

#### Response

##### OCONEE 230KV SWITCHYARD

The following buses supply power to the Oconee 230KV Switchyard instrumentation and control systems to ensure the 230KV Switchyard can function as designed. During a loss of off-site power (LOOP), the 230KV Switchyard will isolate from the grid and align to Keowee Hydro via the overhead path to supply Oconee Nuclear Station with emergency power. The following buses include the DC Power supplies for the 230KV Switchyard Instrumentation and Control Circuits.

#### Class 1E Buses

DYA	SWYD PCB Trip Coil No. 1 DC Power
DYB	SWYD PCB Trip Coil No. 1 DC Power
DYE	SWYD PCB Trip Coil No. 2 DC Power
DYF	SWYD PCB Trip Coil No. 2 DC Power

DYC	Ext. Grid Prot. Relay Channel 1
DYG	Ext. Grid Prot. Relay Channel 2

- a) The following are the alarms/indications associated with the instrumentation and control buses identified in the 230 KV Switchyard.

Switchyard DC Panelboard DYA -	
Switchyard DC Panelboard DYB -	SA6-2, PCB Coil Trouble
Switchyard DC Panelboard DYE -	
Switchyard DC Panelboard DYF -	

Although there is not a specific single alarm assigned to alert the Oconee Operator of the loss of one of the above panelboards, the PCB Coil Trouble Statalarm (SA6-2) will signal a problem with the DC power supply to the switchyard PCB coils and subsequent investigation will identify a loss of power to the specific panelboard.

Switchyard DC Panelboard DYC -	SA15-5, CH 1 DC Sply Fail
Switchyard DC Panelboard DYG -	SA15-7, CH 2 DC Sply Fail

Also, upon a loss to one of the External Grid Protective Relay Channels DC power supply, the Channel 1 or Channel 2 DC Supply Failure Statalarm (SA15-5 or SA15-7 respectively) will actuate.

- b) The loss of any single bus described above will not affect the ability of the switchyard instrumentation and control circuits to function as designed to isolate the 230KV Switchyard from off-site sources. Oconee Nuclear is capable of receiving emergency power from several sources. If the 230KV Switchyard is isolated from the grid by the External Grid Trouble Protective System, one Keowee Unit is aligned to an overhead pathway through PCB-9, to the Yellow Bus and Startup transformers. If the overhead path is not available, a dedicated underground feeder from Keowee Hydro is pre-aligned and one Keowee unit is dedicated to the underground power path through CT-4. If the dedicated underground power path is not available, Oconee Nuclear may receive power from a dedicated line from Lee Steam Station through Central Switchyard and transformer CT-5. Oconee Nuclear may also receive off-site power directly from the 100KV transmission system via the Central Switchyard through transformer CT-5.

The switchyard DC system has been designed primarily to separate primary and backup relaying DC power. In fact, because of the separation of power, a loss of any single bus or its respective loads in either 230KV Switchyard AC or DC distribution system will not affect the ability of an emergency power source to be available to Oconee Nuclear Station.

- c) No modifications necessary.

#### KEOWEE HYDRO STATION

Keowee Hydro Station is comprised of two hydroelectric generators electrically separated and independent. Each unit has its own auxiliary power transformer (1X and 2X) that is capable of providing sufficient power to operate the specific unit. In the event of a failure of one or both auxiliary power transformers, a back up transformer (CX) is available with sufficient capacity to operate both units. A single failure of either transformer would not prevent an emergency start of at least one Keowee unit and therefore would not prevent Oconee Nuclear from reaching a cold shutdown condition.

The following buses supply power to the Keowee Hydro Station instrumentation and control systems:

	<u>Keowee Class 1E Buses</u>	<u>Keowee Non-class 1E Buses</u>
Unit 1	KA 1DA	KC
Unit 2	KB 2DA	KD

The following buses also supply power to Keowee Instrumentation and Control related circuits from Oconee 125VDC Vital Instrumentation and Control Power Sources:

<u>Keowee Related System</u>	<u>Power Source</u>
Keowee Supervisory System	1DID
Keowee Emerg. Start-up Channel A	1DIA, 2DIA, 3DIA
Keowee Emerg. Start-up Channel B	1DIB, 2DIB, 3DIB

- a) The following are the alarms/indications associated with the instrumentation and control buses associated with Keowee Hydro Station:

Keowee Unit 1 Power Panelboard #KA - Indication of loss of loads  
Keowee Unit 2 Power Panelboard #KB - Indication of loss of loads  
Keowee Control Room Power Pnlbd #KC - Indication of loss of loads  
Keowee Control Room Power Pnlbd #KD - Indication of loss of loads

The above listed Power Panelboards are separated by unit and an assessment of the loads concluded that these panelboards are not individually required for Oconee to reach a cold shutdown condition. The loss of power to either KA, KB, KC, or KD can be deduced directly from the loss of its associated loads. Statalarms in the Keowee control room, local alarms and equipment operation indication (Power On/Off lights) are available for loads fed from each of these panelboards. Keowee auxiliary switchgears (1X and 2X) are monitored for Power Supply Trouble and Lockout

Relay actuation by a Keowee control room statalarm to provide indication of loss of power to the operator. Because of the separation of unit power and sufficient indication of loss of power to specific loads, no loss of power alarms or indications are necessary for the panelboards downstream of the switchgears.

Keowee Unit 1 Battery trouble alarm 1SA1/44 - (bus 1DA)

Keowee Unit 2 Battery trouble alarm 2SA1/44 - (bus 2DA)

The Keowee Units 1 & 2 Battery Trouble alarms (1SA1/44 and 2SA1/44) can be used to indicate 1DA and 2DA bus failures respectively. A single loss to either battery bus at Keowee would not affect Keowee's ability to function as designed to provide emergency power to Oconee.

Keowee Supv. System Failure Alarm 2SA17/17

The Keowee Supervisory System power source is monitored by statalarm 2SA17/17.

Keowee Emerg. Start-up Channel A coil monitor relay - 1EL684D comp. pt.

Keowee Emerg. Start-up Channel A Logic DC Power Lost Alarm 1,2,3SA15-29

Keowee Emerg. Start-up Channel B coil monitor relay - 1EL686D comp. pt.

Keowee Emerg. Start-up Channel B Logic DC Power Lost Alarm 1,2,3SA14-29

Both Channel A and B of the Keowee Emergency Start circuitry can receive indication of its respective bus failures via coil monitoring relays. These coil monitoring relays feed computer points 1EL684D and 1EL686D respectively on the Keowee circuit and statalarms 1SA15-29 and 1SA14-29 respectively on the Oconee circuit. Subsequently, the Oconee switchgear, batteries and battery chargers upstream of the 125VDC Vital Power Panelboards are also monitored for loss of power.

- b) A loss of any single bus in either Keowee AC or DC distribution system will not affect the ability of the Keowee Emergency Power System to supply power to Oconee Nuclear Station. A list and description of all associated annunciator alarms for the Keowee Hydro Units are found in Keowee Emergency Power System Design Basis Document, OSS-0254.00-00-2005.

An assessment of the associated loads of the Keowee Unit Auxiliary Transformers and Switchgears has not identified any single bus failure that would prevent at least one Keowee unit from being available to the Keowee Emergency Power System. The Keowee Emergency Start system requires that each Keowee Hydro unit be capable of automatically starting upon initiation of Engineered Safeguard (ES) signal from any of the three Oconee units and each Keowee unit shall be capable of starting and accelerating without AC power supplied to either of its unit auxiliaries (i.e. shall black start). The loss of one Keowee Auxiliary

Switchgear (1X or 2X) will render the respective unit technically inoperable. The inoperable unit will still black start but its operation will be limited to the available capacity of its batteries, governor oil pressure or subsequent restoration of auxiliary power. For a single loss of either Keowee Auxiliary Switchgear only the unit suffering the loss will be affected. The remaining unit will not be affected and is available to the Keowee Emergency Power System. From a power path availability view point, the most limiting condition would be to lose the unit tied to the overhead path. In this scenario, the underground path would remain operable.

Additionally, due to the separation of power sources, any single bus failure in the Keowee 125VDC Distribution System will only affect the associated unit and the other unit will remain available.

The Keowee statalarm panels (SA1, 1SA1, 1SA2, 2SA1, and 2SA2) are presently fed from Control Room Power Panelboards KC and KD. Upon loss of AC power, the Keowee statalarm panels are inoperable causing a loss of vital information to the Keowee operators until AC power is restored. This loss of indication would not prevent either Keowee unit from performing an emergency start.

- c) A recent modification has been installed at Keowee Hydro Station to provide a DC powered indicating lamp to alert the Keowee operators of an emergency start of a Keowee unit. Reference Minor Mod OE-4687.

A dedicated ring-down telephone between Oconee Nuclear Station control rooms and the Keowee Hydro control room has been installed to provide voice communication between the two stations.

A modification to move the Keowee statalarm panel power sources from the Control Room Power Panelboards #KC and #KD to an uninterruptible (battery backed inverter) power source is being developed and scheduled for completion during the first quarter of 1993. Alarms for the Keowee static inverter failures are in place in the Keowee control room. A complete loss of the Keowee inverter would result in a loss of power to the Keowee Statalarm Panels and Keowee Plant Computer. Upon loss of power to either Keowee statalarm panel, an Oconee statalarm will actuate to alert Oconee Unit 1 & 2 Control Room of the loss of the Keowee statalarm panel. Subsequent investigation will identify the loss of the Keowee inverter. A loss of the Keowee inverter or its associated loads would not prevent either Keowee unit from performing an emergency start. Reference Minor Mod OE-4692.

Question 2

Prepare Emergency procedures or review existing ones that will be used by control room operators, including procedures required to achieve a cold shutdown condition, upon loss of power to each class 1E and non-class 1E bus supplying power to safety and non-safety related instrument and control systems. The emergency procedures should include:

- a) The diagnostics/alarms/symptoms resulting from the review and evaluation conducted per item 1 above.
- b) The use of alternate indication and/or control circuits which may be powered from other class 1E or non-class 1E instrumentation and control buses.
- c) methods for restoring power to the bus.

Response

During a loss of off-site power event there are no specific emergency procedures to address a single failure of any one bus in the Keowee or Switchyard AC or DC distribution systems. If Oconee were to experience a Loss of Off-site Power (LOOP), the Emergency Operating Procedures EP/1,2,3/A/1800/01 will direct the Oconee operator action to appropriately assess the unit status and instruct the operator through the emergency scenario. The EP's will lead the operator to use procedures AP/1,2,3/A/1700/11 (Loss of Power) which contain the information necessary as detailed in Question 2a, 2b, and 2c, to restore emergency power to Oconee.

Question 3

Re-review IE Circular No. 79-02, Failure of 120 Volt Vital AC Power Supplies, dated January 11, 1979, to include both class 1E and non-class 1E safety related and non-safety related power supply inverters. Based on a review of operating experience and your review of IE Circular No. 79-02, describe any proposed design modifications or administrative controls to be implemented as a result of the re-review.



Response

An assessment of the Keowee inverter system in accordance with IE Circular No. 79-02 has been performed and the results to the concerns of the circular follow.

1. The Keowee Inverter circuitry does not include time delay devices to delay transfer switching due to transient loading conditions. For synchronization purposes, the Keowee Static Switch does include a one second delay in the retransfer to normal power sequence. Transient loading of the Keowee inverter has not been a historical problem.
2. The Keowee Inverter System does not include a dedicated rectified AC input to the inverter component. It is possible to have excessive DC voltages if the battery bus is eliminated and the charger alone is supplying the inverter; however, it is prohibited by operating procedures to use the battery charger as a "battery eliminator". It is recognized that our present charger system is not sufficiently regulated without the battery bus connected.
3. An alternate AC source is provided with the Keowee Inverter. The transfer switch will not transfer load unless an alternate source is available. To date there has not been any experience with the Keowee Inverter inadvertently switching due to transient loading conditions. Sufficient load capacity remains on the Keowee Inverter system and transient loading conditions are not a problem. No adjustments are deemed necessary at this time.
4. Normal post maintenance and post modification administrative controls are in place to ensure operability following maintenance or testing. Neither the Keowee Inverter nor any component fed from the inverter is considered to be safety related.

A failure of the Keowee inverter or the loss of any of its associated loads will not prevent Keowee from being available to Oconee as a source of emergency power.

References

1. Keowee One Line Diagrams - K-700, K-702, K-703, K-704.
2. Keowee Statalarm Tabulations - KEE-6, KEE-106, KEE-106-1, KEE-206, KEE-206-1.
3. Keowee Control Batteries, DC System Failure - KEE-23, KEE-23-1.
4. Ocone One Line Diagrams - O-702, O-802.
5. Ocone Elementary Drawings - OEE-18, 118, 218 series, OEE-76 series, OEE-120 and OEE-120-1.
6. Keowee Emergency Power System Design Basis Document - OSS-0254.00-00-2005.
7. KM-344.0008 001 - Exide Model 120/17F1 Inverter (with static switch).
8. Ocone Minor Modification - OE-4687, Install DC Indicating Lamp to indicate Keowee Emergency Start.
9. Ocone Minor Modification - OE-4692, Move Power Source for Keowee Statalarm Panels to Uninterruptible Power.
10. IE Bulletin No. 79-27 - Loss of Non-class 1E Instrumentation and Control Power System Bus During Operation.
11. IE Circular No. 79-02 - Failure of 120 Volt Vital AC Power Supplies.