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AUTH.NAME AUTHOR AFFILIATION
TUCKER,H.B. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
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SUBJECT: Forwards info re impact of degraded voltage on safety-related equipment during normal plant operation.

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Duke Power Company
P.O. Box 33198
Charlotte, N.C. 28242

HAL B. Tucker
Vice President
Nuclear Production
(704)373-4531

DUKE POWER

June 18, 1990

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
Switchyard Degraded Voltage

Dear Sir:

By my letter of May 8, 1990, I had provided preliminary information regarding a conceptual design of a proposed modification to resolve problems concerning the 230KV switchyard that my staff recently identified. On June 6, 1990, a conference call between members of my staff and members of the NRC staff was held. During the phone call, the staff raised a concern about the impact of degraded voltage on safety related equipment during normal plant operation. To address this concern, Please find attached a discussion of the impact that degraded voltage has on safety related equipment during normal plant operation.

The resolution of the problems that we have identified through our Design Basis Documentation effort is a high priority item at Duke Power. The proposed modification to be implemented is moving forward. My staff is developing a revision to the technical specification, which will be submitted in the near future. Your continued cooperation and assistance in resolving this issue is greatly appreciated.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

volt01/pfg

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xc: Mr S. D. Ebneter
Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta St. NW
Atlanta, GA 30323

Mr. P. H. Skinner
NRC Resident Inspector
Oconee Nuclear Station

Mr. L. A. Wiens
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555

INFORMATION CONCERNING GRID VOLTAGE ADEQUACY

The N&E breakers utilize the Westinghouse CV-7 relays for undervoltage detection. Relays associated with these breakers are set at 105V tap with 3 sec time delay at 84 volts and tolerance of ± 3%. Based on this setting and considering the tolerance factor, this setting could effectively be as low as 84.875% of the 4160V bus rating. These relays are inverse-time induction type relays.

According to Westinghouse type CV-7 relay published information and at the present relay setting, these relays would trip in approximately 6 seconds at 90% of relay setting. No information is provided on time required for relay to trip while voltage is at relay setting value. See relay curves attached (Attachment 1).

Considering 84.875% of bus voltage and normal unit loads running an analysis was performed to determine voltage levels at safety-related buses and load terminals.

An evaluation of the impact of this voltage on safety-related unit equipment was performed utilizing existing power system calculations and using engineering judgement. A justification of voltage adequacy is summarized below:

- 4KV Motors:
  With 84.875% bus voltage the minimum voltage on a safety-related 4KV motor would be approximately 84.4% (4160V base) which is equivalent to 87.75% (motor base). An analysis was performed using Westinghouse information to examine impact of continuously running the motors at 80% voltage on motor life. This analysis concluded that this condition would not have significant impact on motor life. Copy of analysis is attached. (Attachment 2)

- Overcurrent protective relaying on 4KV Motors:
  Safety-related motor overcurrent relays are set for motor starting. The adequacy of these settings were examined for motor starting at voltages significantly less than 84.87%. The current values associated with continuously running at 84.87% are considerably below the overcurrent relay settings.

- Bus & Cable:
  These are current sensitive equipment. Lower voltage should not have any impact on them. Current capacity of buses & cables are not exceeded.

- 600V &208V Contactors:
  84.875% of bus voltage should not impact contactor coils. See attached manufacturer test information. (Attachment 3)

- 600/208VAC Motors:
  Based on an evaluation of the 600V RBCF motors and similarity to the 4KV motors, the 600/208V safety-related motors which are normally running should not be impacted by this condition.

- Overload Heaters:
  In safety-related applications, one overload heater is sized properly for the load but it only provides alarm indication in the control room. Overload heaters capable of tripping the motors are considerably oversized for the load and is provided to protect the cable.

- Fuses associated with 600V & 208V Circuits:
  Generally, fuses are only provided to protect the control transformers. Control transformers are sized significantly larger than what is recommended by starter manufacturer. Control transformer and fuse current rating should not be exceeded due to lower voltage. Attachment 3 provides more information on this.

- DC Equipment:
  The Battery Chargers are designed to provide rated output DC voltage with input voltage as low as -15% of nominal voltage (575V). With 84.875% of 4KV bus voltage, the input voltage at the chargers would be approximately 82.5% (600V base) or 86% (575V base).

  Based on that the DC system should be at rated voltage. (See attached manufacturer data sheet).

- AC Vital:
  Since the DC is at rated voltage this condition should not have any impact on the AC vital bus.

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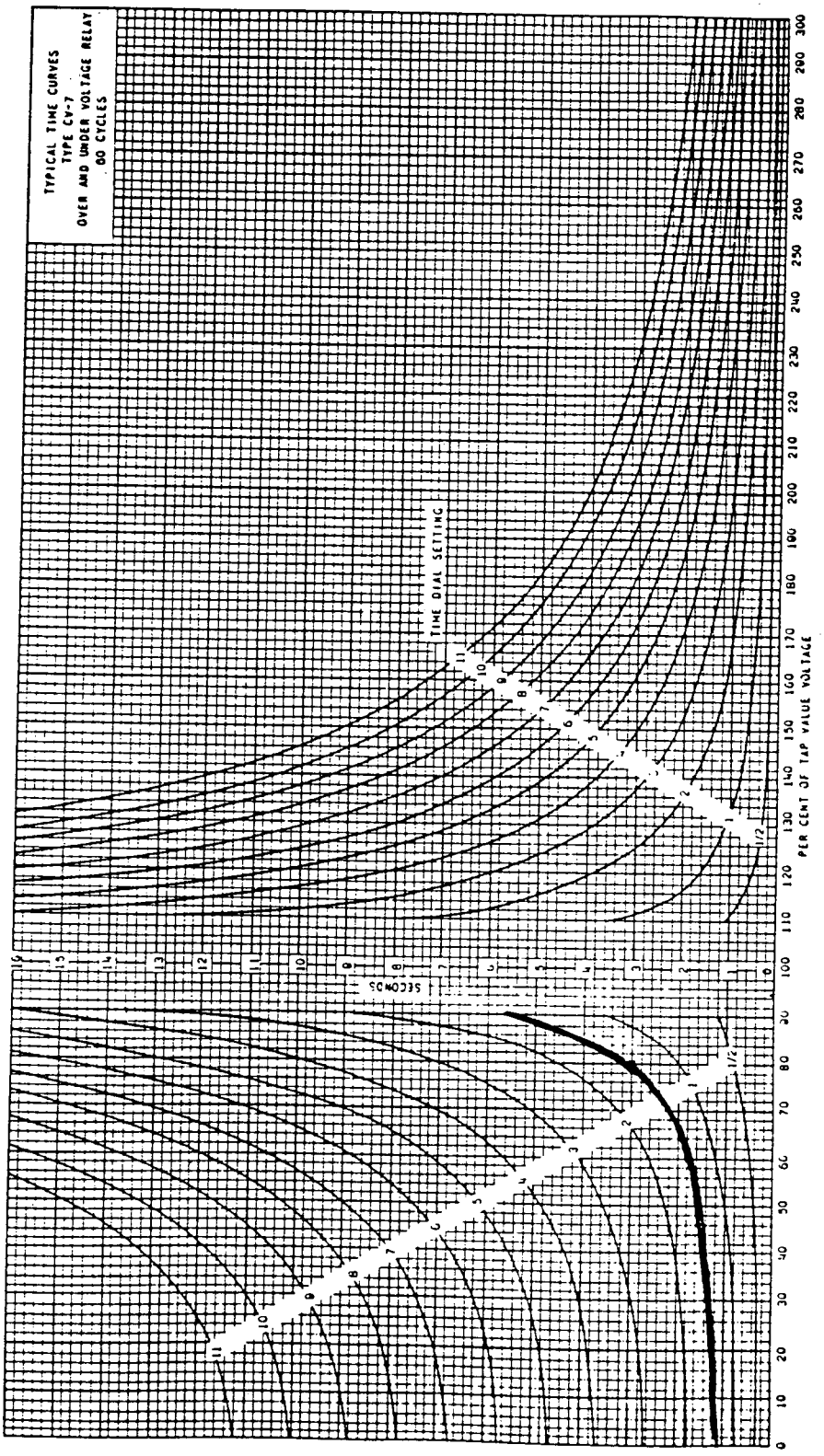

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Fig. 16. Typical 60-cycle time curves of the type CV7 Short Time Over and Undervoltage Relay.