TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

April 15, 1982

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U.S. NUCLEAR REGULATORY COMMISSION
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Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority 50-391

Enclosed are proposed revisions to chapter 8 of the Watts Bar Nuclear Plant Final Safety Analysis Report (FSAR). This information includes revisions which reflect TVA's compliance at Watts Bar with General Design Criterions 17 and 18. A copy of this information was provided informally to the NRC during a meeting on February 17, 1982.

This information will be included in the next amendment to the FSAR.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L M Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Sworn to and subscribed before me
this 15th day of April 1982
Paulette H. White
Notary Public
My Commission Expires 9-5-84

Enclosure
cc: U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

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PDR ADOCK 05000390
A PDR

8.0 ELECTRIC POWER

8.1 INTRODUCTION

8.1.1 Utility Grid and Interconnections

The Tennessee Valley Authority (TVA) is a corporation of the United States Government serving the State of Tennessee and parts of six other states in the southeast on the boundaries of Tennessee. TVA is interconnected with electric power companies to the north, west, south, and east of its service area. As shown in Figure 8.1-1, the TVA grid consists of interconnected hydro plants, fossil-fueled plants, combustion turbine plants, and nuclear plants supplying electric energy over a transmission system consisting of various voltages up to 500 kv.

The Watts Bar Nuclear Plant is located 48 miles northeast of Chattanooga, Tennessee, on the west bank of the Tennessee River. The plant is connected into a strong existing transmission grid applying large load centers. Both nuclear units are connected into TVA's 500-kv transmission system. One unit is connected with three and the other with two 500-kv transmission lines which are integral parts of the 500-kv transmission grid. Normal power for the operation of a nuclear unit is supplied from unit station service transformers when the unit is connected to the transmission system through its main transformer bank. Preferred power is supplied from the existing Watts Bar Hydro 161-kV Switchyard over two radial lines located entirely on TVA property. The Watts Bar Hydro 161-kV Switchyard is interconnected with the TVA power system through [redacted] 161-kV transmission lines, five hydro generators, and four SIX steam generators.

8.1.2 Plant Electrical Power System

The plant electric power system consists of the main generators, the unit station service transformers, the common station service transformers, the diesel generators, the batteries, and the electric distribution system as shown on Figures 8.1-2 and 8.1-3. Under normal operating conditions the main generators supply electrical power through isolated-phase buses to the main step-up transformers and the unit station service transformers located adjacent to the Turbine Building. The primaries of the unit station service transformers are connected to the isolated-phase bus at a point between the generator terminals and the low-voltage connection of the main transformers. During normal operation, station auxiliary power is taken from the main generator through these transformers. During startup and shutdown auxiliary power is supplied from the 161-kv system through the common station service transformers. The standby (onsite) power is supplied by four diesel generators.

16. NEMA TR1, Transformers, Regulators, and Reactors

17. NEMA MG1, Motors and Generators

18. NEMA WC5, Thermoplastic-Insulated Wire and Cable

19. IPCEA S-61-402, Thermoplastic -Insulated Thermoplastic-Jacketed Cables

20. IPCEA S-56-434, Polethylene-Insulated Thermoplastic-Jacketed Cables

21. IPCEA S-66-524, Interim Standard No. 2, XLPE Insulation

22. NFPA No. 78-1971, Lightning Protection Code

23. IPCEA S-19-81, NEMA WC3-1969 IPCEA-NEMA Standards Publication, Rubber-Insulated Wire and Cable. Specific references herein are from the fifth edition dated July 1969.

24. IPCEA S-28-357, NEMA WC1-1963, American National Standards Institute Requirements for Asbestos, Asbestos-Varnished Cloth, and Asbestos-Thermoplastic Insulated Wires and Cable (C8.36-1962).

8.1.5.3 Compliance to Regulatory Guides and IEEE Standards

The extent to which the recommendations of the applicable NRC regulatory guides the IEEE standards are followed is shown below. The symbol (F) indicates full compliance. Those which require further clarification or are not fully implemented are discussed in the footnotes as indicated.

Regulatory Guide 1.6 (Safety Guide 6), "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems." (F)

Regulatory Guide 1.9 (Safety Guide 9), "Selection of Diesel Generator Set Capacity for Standby Power Supplies." (~~F~~)

Regulatory Guide 1.22 (Safety Guide 22), "Periodic Testing of Protection System Actuation Functions." (F)

Regulatory Guide 1.29, "Seismic Design Classification." (F)

37

IEEE Trial-Use Std 338-1971, "Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems." (F)

IEEE Std 344-1971, "Guide for Seismic Qualification of Class I Electrical Equipment for Nuclear Power Generating Stations." (F)

IEEE Std 387-1972, "Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Stations." (F)

1. The electric penetration assemblies at Watts Bar Nuclear Plant are designed in accordance with IEEE 317-1972. REPLACE WITH INSERT K-

2. Regulatory Guide 1.75 was issued after the Watts Bar design was complete. Separations criteria for WBNP are given in Paragraph 8.3.1.4.2.

3. Watts Bar Nuclear Plant shares the vital 125V d.c. power supply between units. REPLACE WITH INSERT D

4. Watts Bar Nuclear Plant Class IE equipment was qualified in accordance with IEEE 323-1971.

5. Watts Bar Nuclear Plant Class 1E equipment was seismically qualified to IEEE 344-1971. Regulatory Guide 1.100 addresses IEEE 344-1975. 35

6. The Watts Bar design complies with all of the positions of Regulatory Guide 1.108, Rev. 1, except as follows: 40.67

   ~~a. Position C.1(5) - This guide was issued too late to incorporate first out annunciation. However, on all diesel generator protective trips such as differential overcurrent, targets have been provided. In addition, the status of protective devices installed to shut down the diesel generator unit for generator or engine trouble are alarmed in the main control room.~~

   ~~b. Position C.2.a(2) - This requirement to be demonstrated at preoperational testing for both full flow and minimum flow conditions. Thereafter, testing will be performed at the minimum flow conditions.~~

   ~~c. Position C.2.a.(7) - This position is not applicable to the Watts Bar design since no switching of fuel supplies is required.~~

~~REPLACE WITH INSERT D~~

Delete this insert and add Insert 8.1-0

7. (Add Insert 8.1-1)

INSERT K

PAGE 8.1-8 (Replaces revisions sent in Package 312 and 327)

A discussion of the degree of conformance of the Watts Bar design with the requirements of RG 1.63 follows:

C.1 The electric penetrations have been designed to withstand the maximum fault current for the time duration of the backup protective device. A redundant overcurrent protection system is provided (redundant breakers or a breaker and a fuse) for all penetrations except instrumentation circuits where fault current is not a problem.

The only 6.9-kV circuit feeding loads inside containment (thus requiring electrical penetrations) are for the reactor coolant pumps (RCP). The breakers associated with the RCPs are backed up by a second breaker to provide the redundant overcurrent protection systems required by RG-1.63. The breakers are provided in the normal course of auxiliary power system design and are non-Class 1E. The primary and backup circuit breakers are each provided with independent dc control power from two different batteries so that the failure of either battery will not violate the single failure criteria. Provision for testing is described below.

The 480-volt load center circuits have a low voltage power circuit breaker backed up by a current limiting fuse. The penetration withstands the available fault current vs. time duation for the load center breaker and fuse. The breakers have direct acting trips and are independent of control power. The fuse is located in the cable termination compartment of the load center bolted to the breaker cable terminal.

The 480-volt motor control center (MCC) circuits have a molded case circuit breaker backed up by a fuse. The penetration withstands the available fault current vs. time duration for the breaker and fuse. Molded case breakers have direct acting trips. The breaker/fuse were furnished in the standard design of the MCC and are located in the same compartment with approximately two inches of air space separation. This is considered adequate because of the diverse principle of operation of the fuse and breaker. 2:1d

Low-voltage control circuits which have sufficient fault currents available to damage a penetration have a molded case breaker backed up by a fuse. The penetration withstands the available fault current vs. time duration for the breaker and fuse. The molded case breakers have direct acting trips.

The energy levels in the instrument systems are sufficiently low so that no damage can occur to the containment penetration.

380

K continued

Table 8.1-2 lists the parameters that show the capability of each typical penetration to withstand without loss of mechanical integrity, the maximum fault current vs. time condition that could occur as a result of a single random failure of the primary overload protection. Thus the single failure criterion of IEEE 279 is met. Figures 8.1-4 through 8.1-10 show typical time-current curves.

In addition to the single failure criterion of IEEE 279, the following requirements of IEEE 279 are met as follows:

1. Testability: The overcurrent protection system provided for 6900-volt penetration circuits include drawn out-type relays which are field testable using manufacturer provided test sets or TVA test sets to simulate fault currents following established procedures. Low voltage power circuit breakers and molded case circuit breakers are field tested using test sets built by Multiamp Corporation or equal. Testing is done by simulating fault current following established procedures.

   The only method recommended by fuse manufacturers for periodic testing of fuses is the measurement of their resistance. Resistance measurement is one of the final checks made at the factory to assure fuses have been manufactured correctly and are properly labled as to size. The validity of duplicating a factory test that measures milliohms in the field is questionable. In lieu of field testing by resistance, we will establish a fuse inspection and maintenance program that will ensure: (1) that the proper size fuse is installed, (2) that the fuse shows no sign of deterioration, and (3) that the fuse connections are tight and clean. (See IEEE Std 242 1975 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems).

Penetration protective devices in 480V circuits energized during plant operation are mounted in either motor control centers or Class 1E low voltage switchgear. Both Class 1E and non-Class 1E motor control centers are ITE Imperial Corporation series 5600 supplied under the same contract. All 480V non-Class 1E distribution equipment that houses penetration protective devices are located in the same seismic structure as Class 1E distribution equipment. Equipment bought to Class 1E standards is qualified to operate both during and after an operating basis earthquake (OBE) or a safe shutdown earthquake (SSE). The non-Class 1E motor control centers supplied under the same contract as Class 1E are manufactured using the same materials and components which results in the same high degree of operational reliability during an OBE.

330

K continued

C.2 X/R ratios in excess of 15 were used in the qualification tests.

C.3 The duration times used in the qualification tests exceeded those required by IEEE 317-1976 and RG-1.63.

C.4 The basic impulse test voltage used in the qualification test for the medium voltage penetration was a 2X50 micro-second phase. The test consisted of a full wave test series of three positive and three negative waves.

C.5 Aging tests in excess of 5000 hours have been run on all non-metalic materials to establish arrhenius curves.

C.6 N/A

C.7 NA

330

A discussion of the degree of conformance of the Watts Bar design with the requirements of RG 1.81 follows:

X ~~[illegible]~~

Position C.1

~~Does Not Fully Comply~~

~~Justification:~~

The design of the WBNP 125-volt vital dc system and the construction permit application was made before June 1, 1973. The design, as a minimum, meets the requirements of position 3 of the subject regulatory guide and branch technical position EICSB 7 as follows: The system is capable of supplying minimum ESF loads and the loads required for attaining a safe and orderly shutdown of the unit assuming a single failure and loss of offsite power. The ESF output relays and their trained loads that require power to operate, are assigned as follows:

1. Unit 1 "A" train - 125V dc Vital Battery I, 120V ac Vital UPS 1-I
2. Unit 1 "B" train - 125V dc Vital Battery II, 120V ac Vital UPS 1-II
3. Unit 2 "A" train - 125V dc Vital Battery III, 120V ac Vital UPS 2-III
4. Unit 2 "B" train - 125V dc Vital Battery IV, 120V ac Vital UPS 2-IV

Thus the ESF loads are not shared.

The 120-volt ac vital instrument power is supplied by four UPS units per unit. They furnish power for the four-channel reactor protection system (RPS) input relays. The relays fail safe, actuate reactor protection system (RPS) signal, on a loss of power, thus a single failure and/or a loss of offsite power does not prevent the safe and orderly shutdown of either unit.

Plant common loads such as emergency gas treatment are supplied from unit 1, channels I and II.

In no case does the sharing inhibit the safe shutdown of one unit while the other unit is experiencing an accident. All shared systems are sized to carry all credible combinations of normal and accident loads.

~~[illegible]~~

Position X C2

a. Watts Bar is a two-unit plant.

b. With a single failure (Loss of a battery or loss of a diesel generator) in the plant sufficient ESF loads are still automatically available to the accident unit and to safely shut down the remaining unit.

c. The most severe DBE is an accident in one unit and a trip of the other unit. Sufficient diesel generator (DG) power is available to attain a safe and orderly shutdown of both units with the loss of one DG unit.

d. The DG units and the standby distribution system are arranged in two redundant trains per unit. Due to the shared ESF system (example: ERCW) only one DG unit per plant can be taken out for maintenance or tested at the same time. With only one DG unit unavailable, this position is met assuming loss of offsite power.

e. No interface of the unit operators is required to meet position 2.b. and 2.c.

f. Control and status indication for the DG units is provided on a central control board (Panel 0-M-26) available to both unit operators. DC system status (volts, current, etc.) is provided on a unit basis.

g. The recommendation of RG-1.6, 1.9, except as discussed in Note 7 and 1.47 are met.

~~* The construction permit for WBNP was issued before June 1, 1973.~~ STCT

Position C. 3

3/77

Insert 8.1-0 (page 8.1-8)

a. **Position C.2.a(2)**

We understand this requirement to mean that the emergency loads be sequenced on to the diesel generator unit (DGU) with each load operating at its full load rating (that is a pump would be operating at full flow). This will be done as part of the preoperational testing program. For subsequent periodic testing done after preops, the loads will be sequenced on as designed except the pumps will be operated with their miniflow connection open and not at full flow.

The most severe disturbance of voltage and frequency for a diesel generator unit (DGU) occurs when starting a motor. Whether a motor is operating at full flow or miniflow, this disturbance is the same. Therefore, the capacity of a DGU to maintain frequency and voltage can be proved with the pumps operating at miniflow. The voltage and frequency will be monitored by control board meters during periodic testing to assure that the frequency and voltage are maintained within design limits.

INSERT 8.1-1

7. Since RG 1.9 has been revised, the following information defines the degree of conformance with RG 1.9 R2.

C.0 WBN meets the intent of IEEE 387-1977

C. 1 Full compliance

C. 2 Full compliance

C. 3 Full compliance

C. 4 Full compliance

C. 5 Environmental qualification of the WBNP diesel generator units will be detailed in TVA's ~~response to Nureg 0588, Category II for Class 1E equipment in a~~ mild envirorment. equipment qualification report to be retained in TVA files per NRC requirements.

C. 6 Full compliance

C. 7 (a) Full compliance

(b) Full compliance

C.8 Does not comply - Although a first-out serveillance system is not installed at Watts Bar, all diesel generator protective trips such as differential overcurrentr have been provided with targets to indicate which protective device operated. In addition, the status of protective devices installed to shut down the diesel generator unit for generator or engine trouble are alarmed in the main control room. Where more than one protective device target is operated, an analysis of the problem will be done to determine which device operated first.

C.9 It is TVA's position that the intent of this position has been fully met. Please refer to ~~[illegible]~~ TVA's response to NRC question 112.22 relating to seismic qualifications of Watts Bar safety- related equipment. In addition, please refer to FSAR Table 3.10.1, sheet 2, for a summary of the seismic qualification of electrical equipment, including the diesel generators. Further Table 3.10.3 "Watts Bar Seismic Qualifications," sheets 11 through 20 for tests, results, and references of the seismic qualification of various components of the diesel generator unit.

C.10 Full compliance

C.11 Full compliance

C.12 N/A

C.13 N/A

C.14 Does not fully comply. The load qualification test was not done as part of the type qualification test. This test has been run as part of the preoperational test program, but the requirements of IEEE 387-1977 were followed. It is TVA's position that running the short-time load test at the end is a more severe test and this sequence is justifiable. However, in order to meet this position, subsequent periodic testing of these DGUs will be done per this regulatory guide.

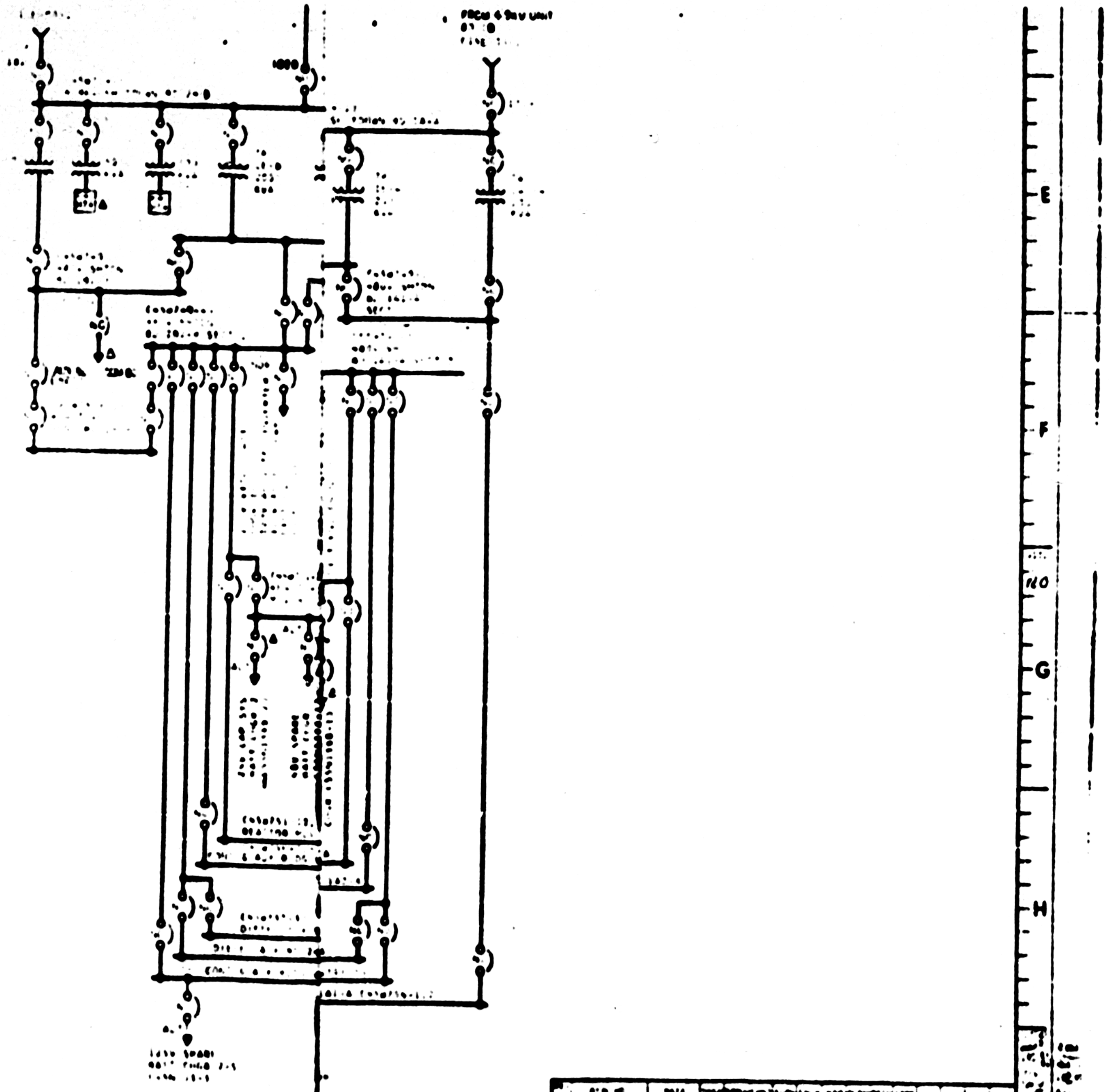
TABLE 8.1-2
ELECTRICAL PENETRATION ASSEMBLY SHORT-CIRCUIT CAPABILITY

Rated Volts	Serv Volts	Wire Size	Rated Short Ckt Sym Amp	Rated I^2t ($x 10^6$)	Tested Short Ckt Sym Amp	Calculated Short Ckt Sym Amp	Primary Device Opening Time Sec	Backup Device Opening Time Sec	Backup Device I^2t ($x10^6$)
8,000	6,900	750 MCM	36,000	2,910	50,000*	27,000	0.0165	2.7 0.0165	1,968 12.03
600	480	350 MCM	30,000	634	35,000**	10,869	0.024	0.05	5.9
600	480	250 MCM	28,000	324	33,900**	5,076	0.014	0.06	1.55
600	480	2/0	22,000	91.7	28,300**	1,917	0.043	0.05	0.18
600	480	4 AWG	12,500	9.01	15,000**	992	0.019	0.018	0.17
600	120 480	8 AWG	6,000	1.41	5,960**	646 576	.054 0.013	0.150 0.07	0.06 0.02
600	125VDC	10 AWG	3,600	0.558	3,900**	31	.1	.1	0.00
600	125VDC	12 AWG	2,300	0.221	2,410**	32.5	0.2	0.2	0.00

*Test current

**These test currents are from the vendor's test report, which been reviewed by TVA and returned to the vendor with the status "Approved With Corrections as Noted." These corrections are minor in nature and do not affect the valididty of this table.

Replace revised Figure 8.1-2 shown in Amendment 44 with the same figure of the previous amendment since the revised figure shows the new fifth diesel generator which has not been formally presented to the NRC. This revised figure will be submitted with the appropriate SAR text at a later date.



SCALE: NTS EXCEPT AS NOTED

GENERAL

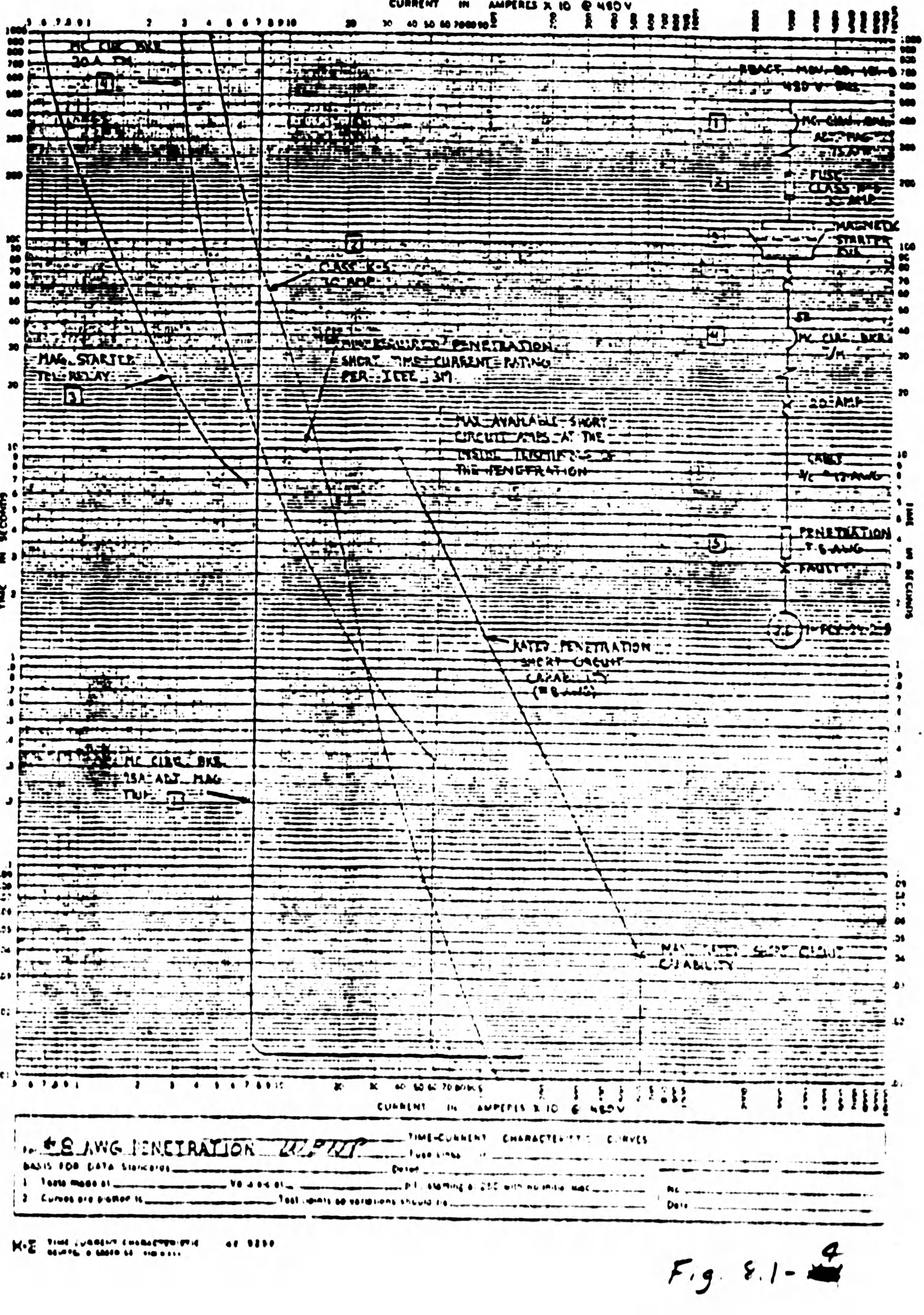
KEY DIAGRAM
STATION AUX POWER SYSTEM

WATTS BAR NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY

Q

NUCLEAR SAFETY RELATED
FSAR FIG. 8.1.2A

KNOXVILLE



#8 AWG PENETRATION
TIME-CURRENT CHARACTERISTIC CURVES

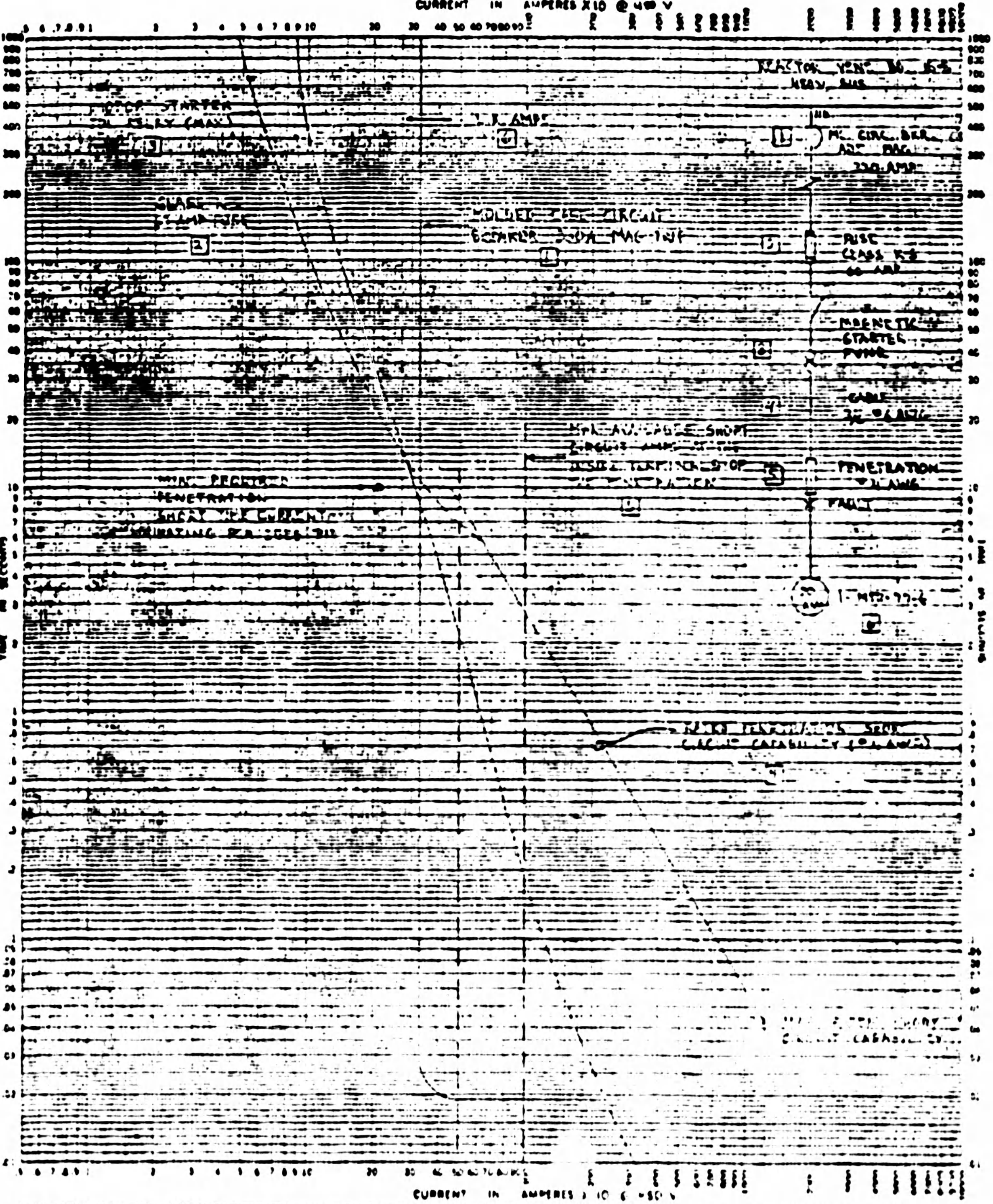
BASIS FOR DATA Standards ______ Date ______

1 Tests made at ______ Volts at ______ P.F. starting at 25C with no initial load ______ No. ______

2 Curves are plotted to ______ Test points so variations should be ______ Date ______

K·E TIME CURRENT CHARACTERISTIC 48 5258

Fig. 8.1-4



To #4 AWG PENETRATION *WENP* TIME-CURRENT CHARACTERISTIC CURVES

Fuse Lines In

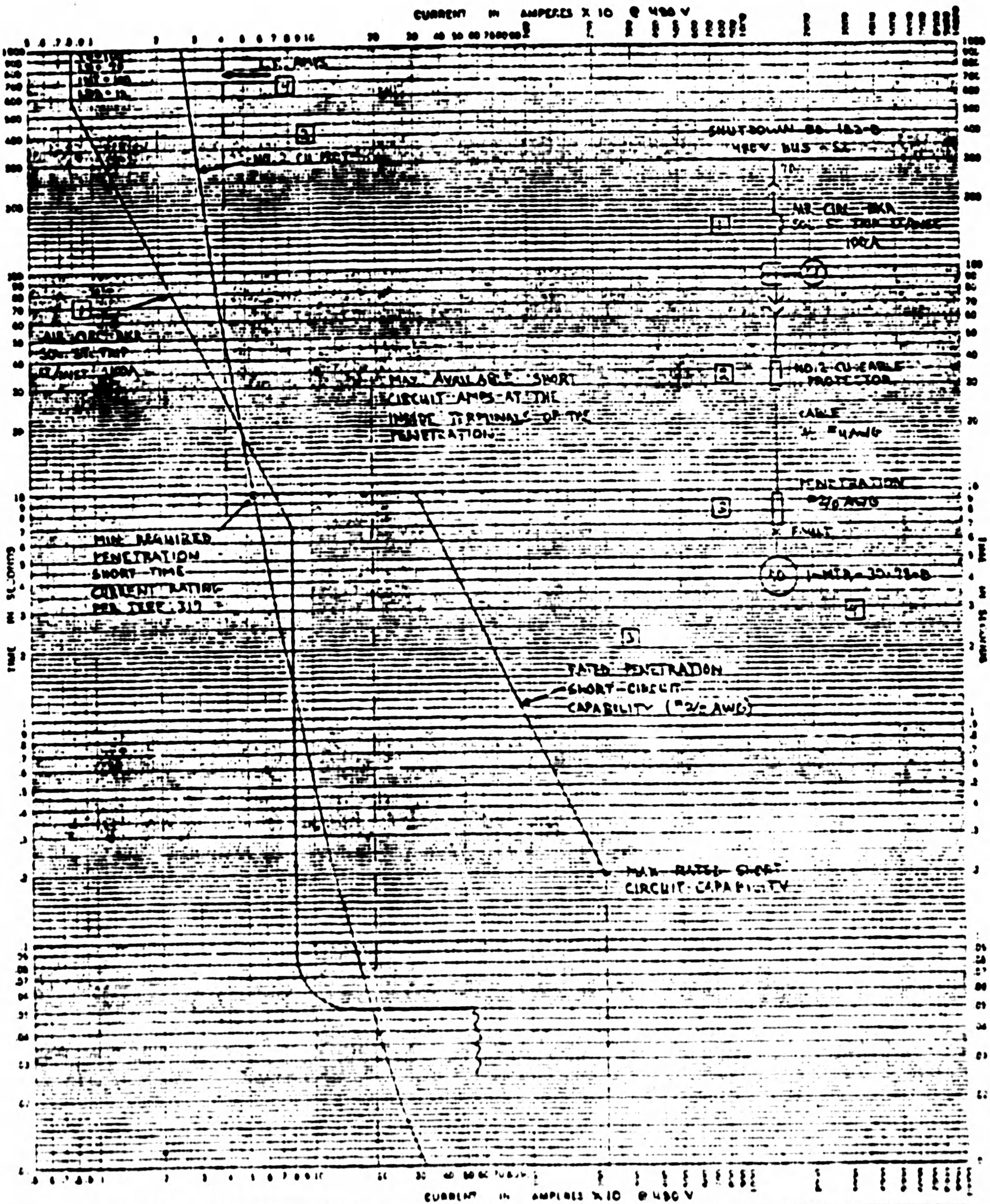
BASIS FOR DATA Supports Color

1 Tests made at Volts a.c. at °F starting at 25C with no initial load No.

2 Curves are plotted to Test points so variations should be Date

K-E [illegible]

Fig. 8.1-5



TIME-CURRENT CHARACTERISTIC CURVES

For #2/0 AWG PENETRATION WBNP

Fuse lines In

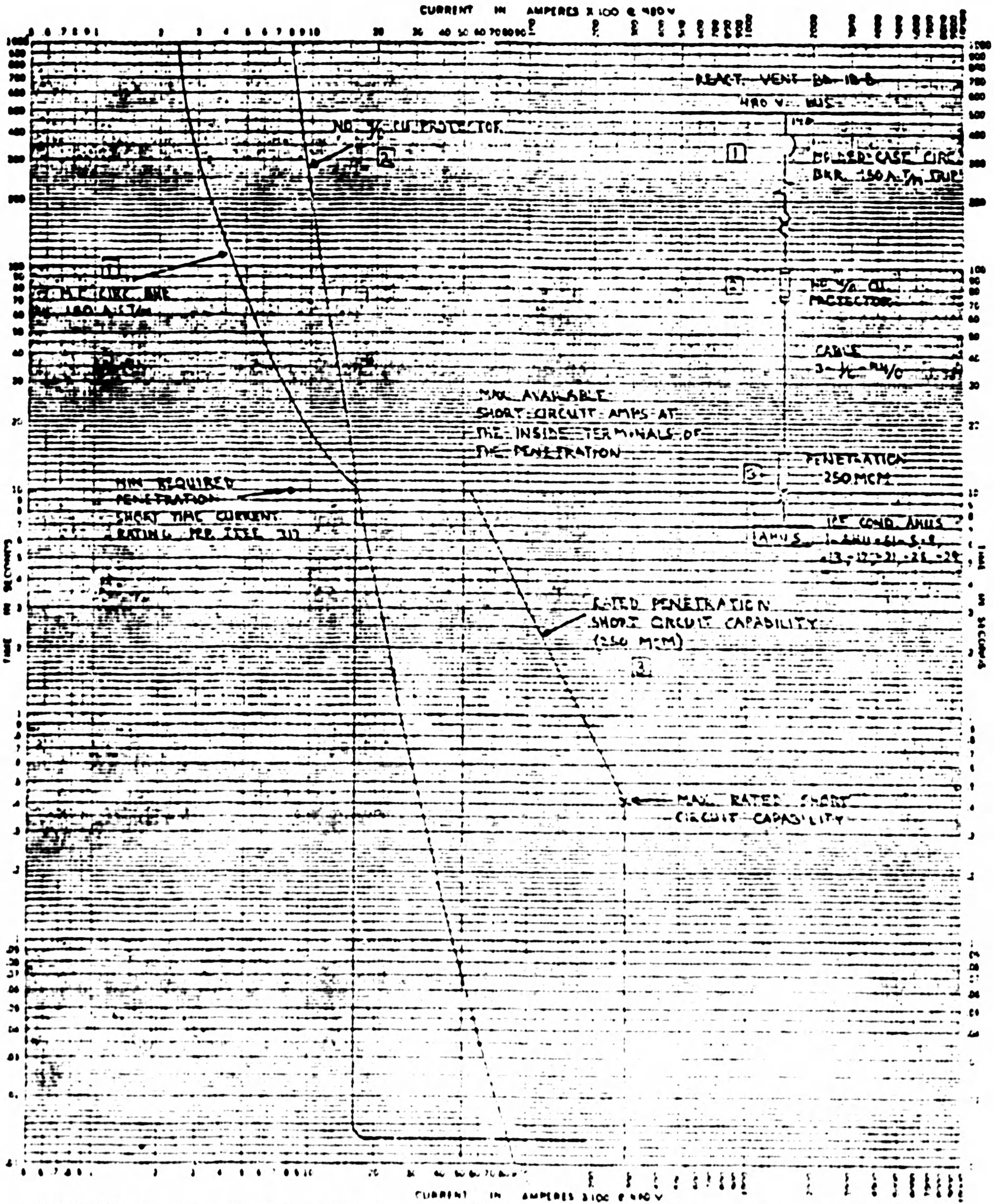
BASIS FOR DATA Standards Notes

1 Tests made at volts and at p.f. starting at 25C with no initial load No

2 Curves are plotted to Test points so variations should be Date

K-E TIME-CURRENT CHARACTERISTIC 48 5258

Fig 8.1-6



TIME-CURRENT CHARACTERISTIC CURVES

For 250 MCM PENETRATION WEHP

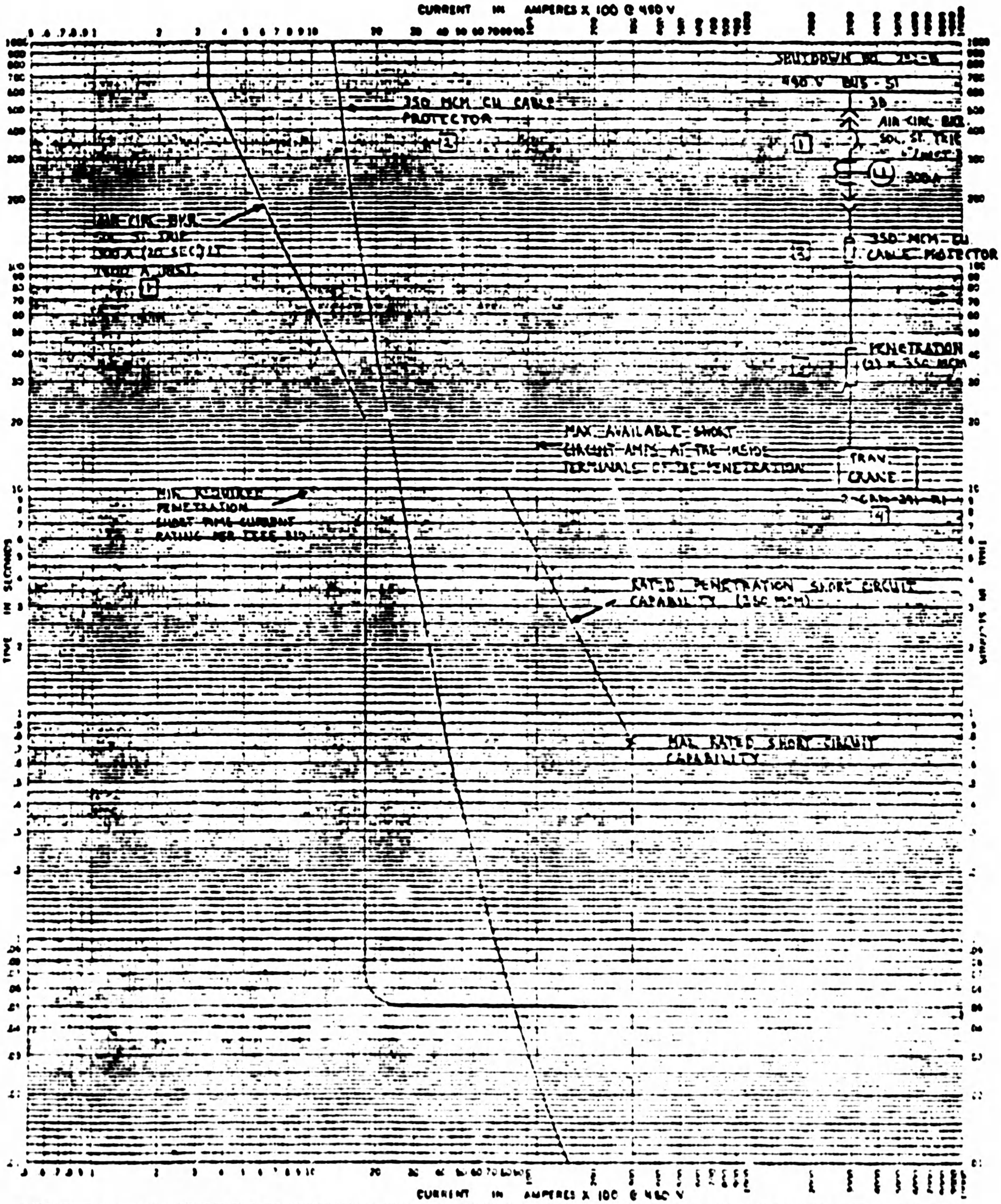
Fuse Lines To ______

Basis for data standards ______ Dates ______

1 Tests made at ______ Volts ______ starting at 25C ______ No. ______

2 Curves are plotted to ______ Test points or variations should be ______ Date ______

Fig. 8.1-7



For 350 MCM PENETRATION WBNP TIME-CURRENT CHARACTERISTIC CURVES

Fuse Links ______ IP ______

BASIS FOR DATA Standards ______ Dated ______

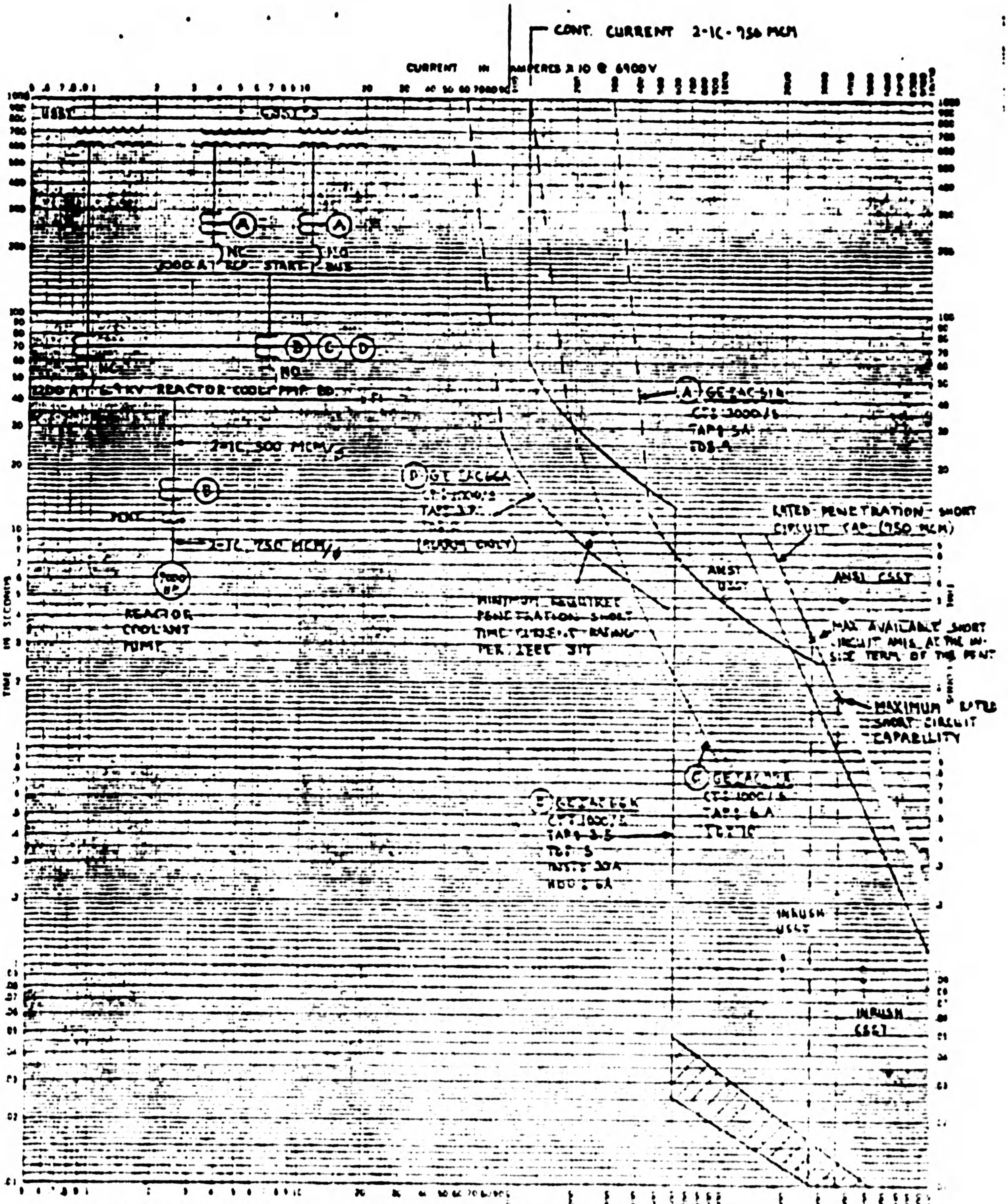
1. Tests made at ______ Volts a c at ______ p.f. starting at 25C with no initial load ______ No ______

2. Curves are plotted to ______ Test points so variations should be ______ Date ______

K-E TIME-CURRENT CHARACTERISTIC 40 5890

Fig 8.1-8

371



750 MCM PENETRATION

OVERCURRENT TIME-CURRENT CHARACTERISTIC CURVES

For WBNP RCP START BUSES Fuse Links

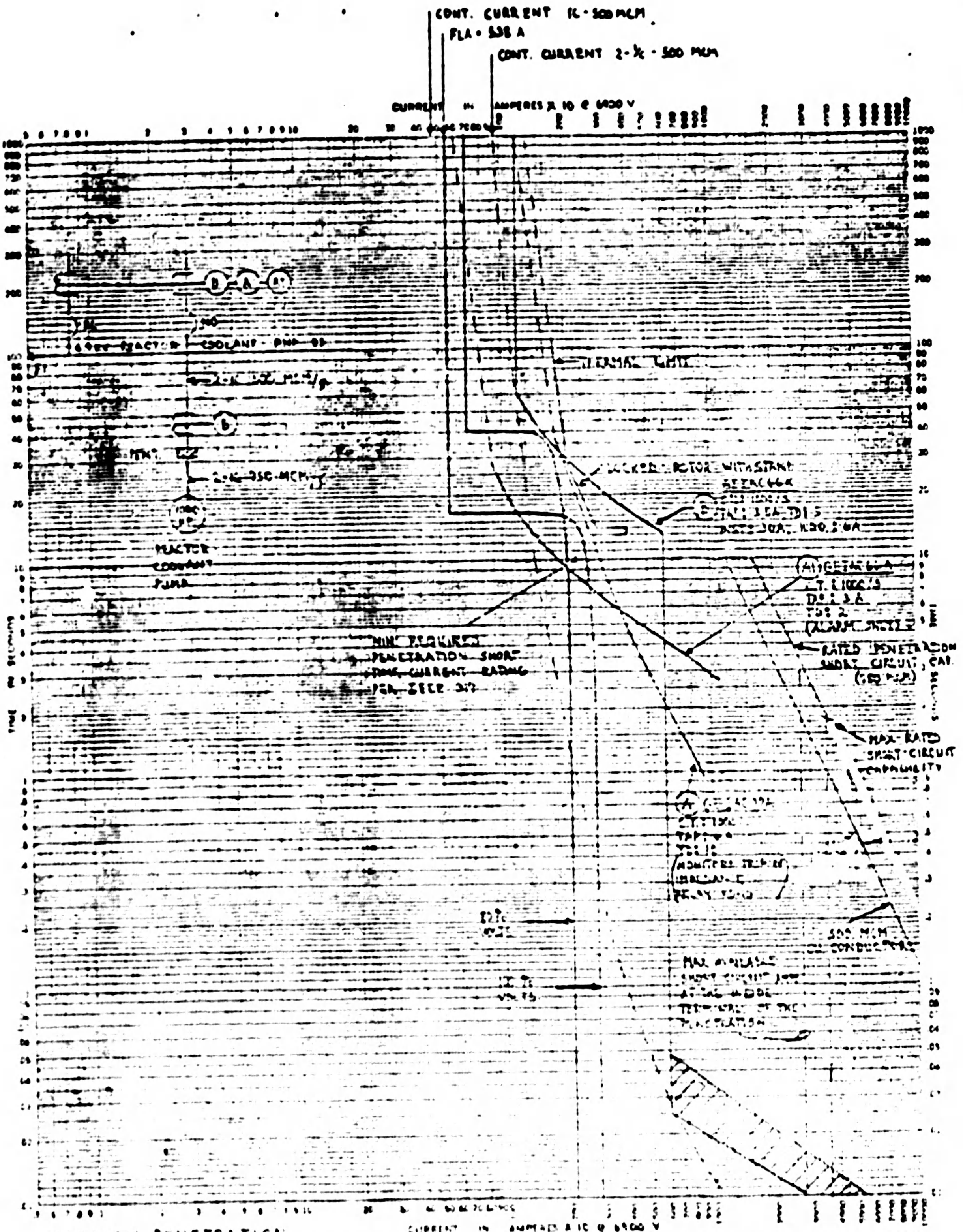
Basis for Data Standards Date

1. Tests made at rated at pf. Starting at 25 with no initial load No.

2. Curves are plotted to Test points so variations should be Date

K-E TIME CURRENT CHARACTERISTIC 48 5258

Fig. 8.1-9



750 MCM PENETRATION

OVERCURRENT TIME-CURRENT CHARACTERISTIC CURVES

For VENT. REACTOR COOLANT PUMP Fuse Lines

Basis for Data Standards Date

1 Tests made at Volts a.c. at starting at 25C with no initial load No.

2 Curves are plotted to Test points so variations should be Date

Fig. 8.1-10

8.2 OFFSITE (PREFERRED) POWER SYSTEM

8.2.1 Description

8.2.1.1 Preferred Power Supply

The features of the offsite power system are shown in Figure 8.2-1, Development Single Line Diagram.

Preferred power is supplied from the existing Watts Bar Hydro 161-kV Switchyard over two 161-kV overhead lines approximately 1.5 miles long, located entirely on TVA property. These two transmission lines will be supported on separate towers, and the separation of the two lines will be sufficient to ensure that the failure of any tower in one line will not endanger the other line.

The Watts Bar Hydro 161-kV Switchyard bus arrangement is designed so that the loss of any one of the four main bus sections will not cause loss of power to ~~either~~ both of the two preferred power source lines to the nuclear plant. The Watts Bar Hydro Plant Switchyard is interconnected with the TVA power system through ~~seven~~ six 161-kV transmission lines and the five Watts Bar hydro generators, as shown on the ~~proposed~~ transmission arrangement, Figure 8.2-2. This switchyard also connects the four steam-driven generators in the Watts Bar Steam Plant which are not generated continuously.

The Watts Bar-Sequoyah and the Watts Bar-Athens 161-kV lines both terminate on the hydro plant switchyard bus 1, section 1. These two lines are on separate rights of way and do not cross each other. The Athens line is approximately 21.78 miles long and terminates in the Athens 161-kV Substation along with 161-kV lines from Fort Loudoun Hydro Plant and Sequoyah Nuclear Plant via Charleston 161-kV Substation. The Sequoyah line is approximately 37.37 miles long and terminates in the 161-kV switchyard at Sequoyah Nuclear Plant. The Sequoyah 161-kV Switchyard is connected to the 500-kV system through an intertie transformer bank, to one of the generating units at Sequoyah Nuclear Plant, to Chickamauga Hydro Plant, and to other substations which are integral parts of the transmission system with either direct or indirect connections to other TVA steam electric or hydro generating plants.

The Watts Bar-Great Falls 161-kV Transmission Line is approximately 53.12 miles long. This line is terminated on bus 2, section 2 in the Watts Bar Hydro Plant Switchyard. At Great Falls Hydro Plant this line is terminated in the 161-kV switchyard along with a second circuit from Watts Bar Hydro which is routed by way of Spring City 161-kV Substation and a 161-kV

The Watts Bar-Great Falls 161-kV Transmission line is approximately 53.12 miles long. This transmission line is tapped to supply the Pikeville 161-kV Substation at a point approximately 30.5 miles from the Watts Bar Hydro Plant. 330

transmission line that interconnects with the power system network through the Murfreesboro 161-kV Substation, McMinnville 161-kV Substation, and the Center Hill Hydro Plant. The Great Falls and the Winchester 161-kV Transmission Lines cross near the Watts Bar Hydro Switchyard.

The Watts Bar-Spring City 161-kV Transmission Line is approximately 7.38 miles long. It is terminated on bus 1, section 3 in the Watts Bar Hydro Plant Switchyard. At Spring City this line is terminated on the 161-kV bus along with a 161-kV line that extends to Great Falls Hydro Plant. The Spring City and Winchester lines that extend from Watts Bar Hydro Plant cross near the switchyard.

The Watts Bar-Rockwood and the Watts Bar-Winchester 161-kV Transmission Lines are terminated on bus 2, section 4 in the Watts Bar Hydro Plant Switchyard. The Rockwood line is approximately 23.67 miles long and is terminated on the Rockwood 161-kV bus along with 161-kV lines from ~~Kingston Steam Plant and Crossville 161-kV Substation.~~ The Crossville 161-kV Substation and the 161-kV switchyard of the Roane 500-kV Substation. The 161-kV transmission line from Roane is looped into the Harriman 161-kV Substation. Two MOD's at Harriman provide for automatic sectionalizing of the Rockwood-Harriman-Roane 161-kV Transmission Line in the event of a permanent fault on the line. The Crossville 161-kV Substation and Kingston Steam Plant are further connected to the TVA 161-kV transmission system network. The Watts Bar-Rockwood line is on a separate right of way and does not cross other lines that terminate at Watts Bar Hydro Switchyard. The Winchester 161-kV Transmission Line is approximately 76.2 miles long and terminates at Winchester 161-kV Substation by way of the Dayton and Coalmont 161-kV Substation Taps. The Winchester, Spring City, and Great Falls 161-kV Transmission Lines have crossings near the Watts Bar Hydro Plant Switchyard.

Two 161-kV transmission lines extend approximately 1.5 miles from Watts Bar Hydro Plant Switchyard to the Watts Bar Nuclear Plant site to furnish preferred power to the nuclear plant. One of these lines is terminated on bus 1, section 1 and bus 2, Section 2. This line does not cross other 161-kV lines. The other preferred power 161-kV transmission line is terminated on bus 2, section 4 and bus 1, section 3 in the hydro plant switchyard. This line crosses over the Spring City and the Great Falls 161-kV Transmission Lines near the hydro plant switchyard (Figure 8.2-2).

The transmission line structures for all 161-kV lines described are designed to exceed load requirements specified in the National Bureau of Standards Handbook No. 81 (National Electric Safety Code Part 2). Designing to these requirements ensures the adequacy of lines for wind and heavy icing conditions in excess of those that would be expected to occur in this area. The phase conductor and shield wire design tensions are selected to avoid vibration and galloping conductor problems. Long experience with area transmission lines verifies that TVA design practices have been successful in avoiding vibration problems. No galloping conductor conditions have been observed in the eastern portion of the TVA transmission system.

Transmission lines in the 161-kV voltage class have two overhead ground wires provided for lightning protection. This shielding has been effective for an area isokeraunic level of 55 and is reflected in the average operating record of only 3.86 flashover interruptions annually per 100 miles of line.

The use of circuit breakers with high speed reclosing relays results in the majority of these interruptions being momentary.

8.2.1.2 Transmission Lines, Switchyard, and Transformers

~~The two 161-kV and the five 500-kV lines connecting the plant with the TVA transmission network are indictated functionally on Figure 8.2-1. The onsite transmission line arrangement is shown on Figure 8.2-3 and the offsite transmission line routing in the vicinity of the switchyard is shown on Figure 8.2-2. Preferred power will be supplied from the existing Watts Bar hydro 161kV switchyard (Figure 8.2-4) over two radial 161-kV overhead lines approximately 1.5 miles long. These lines are routed to minimize the likelihood of their simultaneous failure.~~

~~Location of the Common Station Service Transformers is shown on Figure 8.2-5. Physical separation is 61 feet, centerline to centerline and 35 feet between closest parts. Fire protection has been provided for each, with a water sprinkler system which can be automatically activated by thermostats or the transformer electrical protection devices. Each transformer has a single primary and two secondary windings. The primary voltage is 161-kV, rated 57/76/95, OA/FA/FOA. The secondary voltage is 6.9 kV and each is rated 36/48/60, OA/FA/FOA.~~

REPLACE WITH INSERT 8.2-1

8.2.1.3 Arrangement of the Start Boards, Unit Boards, Common Boards, and Reactor Coolant Pump (RCP) Boards

~~From the lowvoltage side of each common station service transformer, 6.9-kV station service buses supply the 6.9-kV common, unit, and RCP boards via the 6.9-kV start boards.~~ These station service buses are outdoor, nonsegregated, partially ventilated, metal-clad structures and are shown on Figure 8.2-5. At the 6.9-kV start board these buses enter the outdoor metal-clad switchgear and connect to supply breakers. The design of the 6.9-kV start boards and RCP boards conforms to ANSI, C 37.20 (Standard for Switchgear Assemblies Including Metal-Enclosed Bus) and is classified as outdoor metal-clad switchgear. Section 20 6.2.2 of this standard defines the requirements for barriers. The circuit breakers at the 6.9-kV start boards are electrically operated, vertical lift drawout type, with stored energy mechanisms. These circuit breakers have a continuous rating of [illegible] a, an insulation level of [illegible], interrupting rating of [illegible] MVA, and a momentary rating of [illegible] amperes.

REPLACE w/ INSERT 8.2-2

INSERT 8.2-1

8.2.1.2 Transmission Lines, Switchyard, and Transformers

The two 161-kV and the five 500-kV lines connecting the plant with the TVA transmission network are indicated functionally on Figure 8.2-1. The onsite transmission line arrangement is shown on Figure 8.2-3 and the offsite transmission line routing in the vicinity of the switchyard is shown on Figure 8.2-2. Preferred power is supplied from the existing Watts Bar hydro 161-kV switchyard (Figure 8.2-4) over two radial 161-kV overhead lines approximately 1.5 miles long. These lines are routed to minimize the likelihood of their simultaneous failure.

The location of Common Station Service Transformers A and B is shown on Figure 8.2-5. Physical separation is 61 feet, centerline to centerline and 35 feet between closest parts. Each transformer has a single primary and two secondary windings. The primary voltage is 161-kV, rated 57/76/95, OA/FA/FOA. The secondary voltage is 6.9 kV and each is rated 36/48/60, OA/FA/FOA. The location of Common Station Service Transformers C and D is also shown on Figure 8.2-5. Physical separation is 70 feet, centerline to centerline and 49 feet between closest parts. Each transformer has a single primary and two secondary windings. The primary voltage is 161-kV, rated 27/36/45, OA/FA/FOA. The secondary voltage is 6.9 kV and each is rated 15/20/25, OA/FA/FOA. Fire protection has been provided for each, with a water sprinkler system which can be automatically activated by thermostats or the transformer electrical protection devices.

3/27

INSERT 8.2-2

From the low-voltage side of each common station service transformer (CSST) A and B, 6.9-kV station service buses supply the 6.9-kV common, unit, and RCP boards via the 6.9-kV start boards. CSST's C and D are connected to their respective 6.9-kV switchgear via bus identical to CSST's A and B bus. CSST's C and D switchgear is then connected to the 6.9-kV shutdown boards via cables. The cables are routed through conduit banks and cable trays to the 6.9-kV shutdown boards.

The circuit breakers are utilized at 6.9-kV. Therefore, there is sufficient margin between the application and the rating of these circuit breakers.

From the 6.9-kV start board the two 6.9-kV start buses A and B and the two 6.9-kV RCP start buses A and B run on separate support structures as outdoor, nonsegregated, partially ventilated metal-clad assemblies.

The bus bars are fully insulated with flame-retardant material, bus supports are flame-retardant, and the metal enclosures are such that arcing faults in one bus will not endanger the other. The 6.9-kV start buses enter the Turbine Building spaced 8' 6" centerline-to-centerline and continue on this spacing across the building. The 6.9-kV RCP start buses enter the RCP outdoor metal-clad switchgear and connect to supply breakers.

The 6.9-kV unit and common boards are indoor, metal-clad switchgear with electrically operated, vertical lift drawout breakers with stored energy mechanisms.

The four unit station service transformers are located in the transformer yard, south of the Turbine Building and directly under the delta section of the isolated-phase main generator bus. Location of the Unit Station Service Transformers is shown on Figures 8.2-5 and 8.2-6. From each of the unit station service transformer low-voltage sides two 6.9-kV buses originate, one running in the switchyard parallel to the south wall of the Turbine Building and connecting to the RCP switchgear, and the other entering the south Turbine Building wall for routing to the unit and common boards. The unit station service buses are outdoor, nonsegregated partially ventilated metal-clad construction until they enter the Turbine Building, where the construction changes to indoor type. After entering the Turbine Building, the unit station service buses are routed to the appropriate supply breakers in the 6.9-kV unit and 6.9-kV common boards, entering through the tops of the 6.9-kV unit boards and the bottoms of the 6.9-kV common boards.

All of the indoor station service buses are nonventilated, nonsegregated, metal-clad dripproof construction. In addition, the outdoor portions are weatherproof and equipped with 120V 1-phase heaters to maintain the temperature inside the housing at least 5°C above outside temperature. All buses are provided with gas-resistant seals at entry to a piece of switchgear. At the penetration of an outside building wall, the buses are provided with a fire-resistant and moisture-resistant barrier.

8.2.1.4 Arrangement of Electrical Control Area (Nuclear Plant)

Figure 8.2-7 shows the electrical control area where the relay, control, and 250V d.c. control power distribution panels are located.

Control power for power circuit breakers and associated protective relays is distributed from the 250V d.c. supply via circuit breakers on the control room d.c. distribution board. 29

Physical isolation of control power supplies for control of the two preferred power circuits is achieved by metal barriers between adjacent panels.

Two separate 250V d.c. buses are provided in these panels. Each bus can be fed from one of the two 250V battery boards through manual, mechanically interlocked, nonautomatic circuit interrupters. The power circuit breaker and associated relay control circuits are allocated to these two d.c. buses on the basis of switchyard connections. This allocation of control circuits ensures that the control and relay circuits of the two common station service transformers are fed from two independent d.c. distribution buses. Each such circuit is protected by a 30-ampere circuit breaker and supervised by an amber indicating light located on the recording and instrument board. These indicating lights are grouped on the panel on the basis of the d.c. buses they are connected to, and their wiring is physically separated on the panel on the same basis.

Each common station service transformer is protected by a percentage differential relay with harmonic restraint, a sudden pressure relay, and a neutral overcurrent relay in the 6.9-kV winding neutral.

The operation of the transformer protection relays will trip and lock out the power circuit breakers connecting it to the switchyard, trip and lock out associated 6.9-kV circuit breakers, and start a high-pressure sprinkler system to prevent or extinguish any possible fire.

8.2.1.5 Switchyard Control and Relaying

The design of the offsite power system with its provision of two immediate access circuits from the transmission network, complies with the NRC regulatory position expressed in the Regulatory Guide No. 1.32 for the preferred design of such a system.

The transmission line relay protection circuits continuously monitor the conditions of the offsite power system and are designed to detect and isolate the faults with maximum speed and minimum ~~of~~ disturbance to the system.

The principal features of these schemes are described below. The 161-kV lines are protected by three-zone (reversed third zone) step distance phase relays augmented with directional comparison carrier blocking and have directional overcurrent carrier ground and backup ground relays. The relay potential circuits are fed from a set of potential transformers connected to each main bus section.

The 161-kV transmission line protective relays system is designed to maximize the reliability of the incoming power to the plant. The protective relaying provides for fast detection of faults and should the transmission line protective relays fail to clear the fault, adequate backup protection is available in the form of bus breakup relays. The bus breakup relays consist of impedance and ground relays. ~~that initiate a timer.~~ If the fault is not cleared within the time setting of the timer, all breakers connected to the bus section of the faulted line will be tripped and locked out.

INSERT 8.2-3

The Watts Bar Hydro 161-kV switchyard is protected by a bus differential relay scheme. The bus differential relays continuously monitor the current inflow and outflow from the bus section under their supervision. Whenever the current inflow does not equal the current outflow, the relays operate instantaneously to trip and lock out all breakers in their protected bus section. The bus breakup relays back up the differential relays should they fail to operate. In addition to the line and bus protection schemes, the 161-kV switchyard power circuit breakers are protected by breaker failure relays with current supervision from separate current transformers on the breaker. The breaker failure relays operate through a timing relay and should a breaker fail to trip within the time setting of its timing relay, the associated breaker failure trip relay will trip and lock out both breakers in that particular switchyard bay and also trip and lock out all breakers connected to the bus associated with the failed breaker.

The supply to the common station service transformers A and D and B and C possesses a high degree of reliability even under electrical fault conditions. The following discussion describes the sequence of events following postulated faults:

1. Transmission line fault.

   If the instantaneous element of the line protective relays is actuated the line breaker is tripped and a high speed reclosure occurs. If after the high speed reclosure the fault has not cleared, the breaker will trip again and a standard speed (synchronism check-voltage check) reclosure occurs. In the majority of the cases these reclosures restore the line back to service. However, a trip after

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INSERT 8.2-3.

For high magnitude faults, the switchyard is instantaneously divided by circuit breaker operation so that offsite power circuits to Watts Bar Nuclear Plant are served from separate buses of the switchyard.

this will lock out the breaker isolating the fa
There is no appreciable disturbance on the two
the common station service transformers.

2. Transmission line fault and failure of the line
breaker to clear the fault.

The corresponding main bus breakup relay and bre
ure relay is automatically initiated, starting a
If the fault is not cleared within the time sett
timer, all circuit breakers connected to that bu
tripped and locked out. With normal position of
breakers described previously, both ~~common statio~~
~~transformers~~ continue to receive power without i

3. Main bus fault.

This type of fault is detected by the bus differe
protection. When initiated, it trips and locks o
circuit breakers connected to the faulted bus. T
of this action are similar to those described und

4. Transformer or transformer feeder faults.

These faults cause tripping of all the transformer
breakers on the high and low voltage side of the t
former. In addition, the trip relay initiates the
former fire protection sprinkler and starts the fi

5. Common transformer or transformer feeder fault and
of one HV circuit breaker to operate properly.
(161 KV)

These events cause the operation of protection desc
under 4 above, followed by the operation of the bre
failure relay which trips all breakers conncected t
bus at the time of failure. The event results in t
of one transformer; the other transformer continues
receive power from its main bus in the hydro switchy

The allocation of the 250V d.c. control power circuits f
lays and circuit breakers (the description of which is i
in the preceding section) is coordinated with the switch
requirements of the zig zag main and transfer bus arrang
and the requirement for the optimum availability of the c
station service transformers A and B.

8.2.1.6 6.9-kV Start Boards Control and Relaying

The secondaries of the common station service transformer
(CSST) A and B feed into two start boards containing four circui

breakers each. Two of the circuit breakers, 1512 and 1614, are the normal and alternate feeders for start bus A while the two breakers 1612 and 1514 are the normal and alternate feeders for start bus B. Two other breakers, 2512 and 2614, are the normal and alternate feeders for RCP start bus A, while breakers 2612 and 2514 are the normal and alternate feeders for RCP start bus B. The two circuit breakers feeding each start bus from a different CSST are interlocked and the control circuits arranged in such a manner that manually-initiated high speed (5 cycles or less) transfers can be made from either breaker to the other breaker. Automatic transfers can only be made from the normal breaker to the alternate breaker and are delayed until the bus residual voltage reduces to 30 percent of normal. All automatic transfers are initiated by undervoltage on the bus. The 250V d.c. normal control power for the pair of breakers feeding start bus A is supplied from a separate battery and d.c. distribution board from that of the normal control power for the two breakers feeding start bus B. Alternate control power feeders are similarly segregated.

Manual control of the circuit breakers is provided on the electrical control board in the Main Control Room where the operator has instrumentation showing the voltage on each of the two buses and current flowing in each of the four feeder breakers. The following annunciation is provided:

1. Start Bus Fan Failure
2. Start Bus Transfer
3. Start Bus Failure or Undervoltage

INSERT 8.2-4

Annunciation No. 3 is composed of bus differential relay operation, bus a.c. voltage failure, and control bus d.c. voltage failure. Start Bus A is the normal feeder to 6.9-kV common board A and the alternate feeder to 6.9-kV unit boards 1A, 1C, 2A, and 2C. Start bus B is the normal feeder to 6.9-kV common board B and the alternate feeder to 6.9-kV unit boards 1B, 1D, 2B, and 2D.

8.2.1.7 6.9-kV Unit and RCP Board Control and Relaying

The alternate feeder to each 6.9-kV unit and RCP board is from one of the start buses with the normal feeder being from a unit station service transformer.

Each 6.9-kV unit and RCP board can be selected for automatic or manual transfer between the normal and alternate supply breakers. Manual transfers are high speed (5 cycles or less) and can be made from the normal to the alternate supply or from the alternate to the normal supply. Automatic transfers can only be

INSERT 8.2-4

The secondaries of common station service transformers C and D (CSST) feed into two start boards containing two circuit breakers each. One of these circuit breakers, 1712 provides power directly to 6.9-kV shutdown boards 1A-A and 2A-A while circuit breaker 1812 provides another source of power to the same 6.9-kV shutdown boards. One other breaker, 2714, provides power directly to 6.9-kV shutdown boards 1B-B and 2B-B while circuit breaker 2814 provides another source of power to the same 6.9-kV shutdown boards. All four of the above circuit breakers are normally closed with no provision for automatic or manual transfers between circuit breakers. The 125-V dc normal control power for circuit breakers 1712 and 2714 is supplied from a separate battery and dc distribution board from that of the normal control power for circuit breaker 1812 and 2814. The alternate control power feeders for these circuit breakers are similarly segregated.

Manual control of the circuit breakers is provided on the electrical control board in the main control room where the operator has instrumentation showing the voltage on each of the two buses and the current flowing in each of the four feeder breakers.

The following annunciation is provided:

1. Loss of Control Power
2. Bus Failure or Undervoltage.

made from the normal to the alternate supply. Automatic transfers initiated by loss of voltage on the unit board are delayed unitl the bus residual voltage decreases to 30 percent of normal. Those transfers initiated by reactor trip or turbine trip signals on the unit or RCP boards are high speed transfers. Control power is from the 250V d.c. distribution system.

The unit and RCP boards are protected by overcurrent, ground overcurrent, and differential current protective relays. Manual control of the two feeder breakers of each board is provided in the Main Control Room. The operator has instrumentation that gives the voltage of each board and the current flowing in either of the two feeder breakers. The following annunciation is provided:

1. Unit and RCP Board Transfer

2. Unit and RCP Board Failure or Undervoltage

Annunciation No. 2 is composed of board differential relay operation, board a.c. voltage failure, and control bus d.c. voltage failure.

~~The final link to the onsite (standby) power system (the 6.9-kV shutdown boards) is feeders from the unit boards. Unit boards 1B, 1C, 2B, and 2C are the normal supplies to 6.9-kV shutdown boards 1A-A, 1B-B, 2A-A, and 2B-B, respectively, while unit boards 1A, 1D, 2A, and 2D are the alternate supplies respectively. These feeders are protected by overcurrent and ground overcurrent relays. All of these feeder breakers are normally closed with all transfers between the normal alternate feeders occurring at the 6.9-kV shutdown board.~~

REPLACE w/ INSERT 8.2-5

8.2.1.8 Conformance with Standards

This section discusses provisions included in the design of the offsite power system to achieve a system design in conformance with requirements of GDC 17 GDC 18 and NRC Regulatory Guides 1.6 and 1.32.

The following requirements of ~~Regulatory Guides 1.6 and 1.32 and GDC 17 are applicable:~~ these documents apply to offsite power.

Regulatory Guide 1.6

Regulatory Guide 1.6 requires that "Each a.c. load group should have a connection to the preferred (offsite) power source. A preferred power source may serve redundant load groups."

INSERT 8.2-5

The final connections to the onsite (standby) power system (the 6.9-kV shutdown boards) are feeders from the unit boards and common station service transformers C and D. Unit boards 1B, 1C, 2B, and 2C are the normal supplies to 6.9-kV shutdown boards 1A-A, 1B-B, 2A-A, and 2B-B, respectively. Common station service transformers C and D provide the alternate power sources directly to the 6.9-kV shutdown boards. Common station service transformer C provides alternate No. 1 power to 6.9-kV shutdown boards 1A-A and 2A-A through circuit breaker 1712 and alternate No. 2 power to 6.9-kV shutdown boards 1B-B and 2B-B through circuit breaker 2714. Common station service transformer D provides alternate No. 1 power to 6.9-kV shutdown boards 1B-B and 2B-B through circuit breaker 2814 and alternate No. 2 power to 6.9-kV shutdown boards 1A-A and 2A-A through circuit breaker 1812. These feeders are protected by overcurrent and ground overcurrent relays. All of these feeder breakers are normally closed with all transfers between the normal, alternate No. 1 and alternate No. 2 feeders occurring at the 6.9-kV shutdown boards.

seconds following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained."

5. "Provisions shall be included to minimize the probability of losing electrical power from any of the remaining sources as a result of, or coincident with, the loss of power from the transmission network, or the loss of power from the onsite electrical power sources."

< INSERT 8.2-6

Each of the above requirements and the provisions included in the design to meet them is addressed in the discussion which follows.

The discussion is arranged in two parts:

1) Physical measures for achieving independence and physical measures taken to minimize the likelihood of failures of portions of the offsite power system inducing failure of the other power sources and 2) functional provisions for achieving adequate capacity, capability, and availability; functional measures taken to minimize the likelihood of failure of portions of the offsite power system inducing failure of other power sources.

Physical Measures

~~The two common station service transformers and buses are connected and arranged to provide two physically independent offsite power circuits to the onsite distribution system. Either of these can be used as the preferred power supply. The outdoor portions of the buses are weatherproof and equipped with 120V, 1 phase heaters to maintain the temperature inside the housing at least 5°C above outside temperature. The conductors are fully insulated with flame-retardant material, bus supports are flame retardant, and the metal enclosures will prevent any arcing fault in one bus from damaging the other bus.~~

REPLACE w/ INSERT 8.2-7

The common station service buses A and B maintain 61 feet centerline-to-centerline separation, until they converge at the unit start board. The buses run on separate support structures and run approximately 15 feet before entering the unit start board. At the unit start board these buses enter the outdoor, metal-clad switchgear and connect to the board supply breakers. The buses are provided with gas resistant seals at the entry to the switchgear. The supply and feeder breakers at the 6.9-kV unit start board are electrically operated, vertical lift drawout type, with stored energy mechanisms. The unit start board consists of a normal feeder breaker and an alternate feeder breaker for each of the 6.9-kV start buses A and B and the [illegible]

INSERT 8.2-6

General Design Criterion 18 requires that the offsite power circuits be designed to permit periodic inspection and testing to show:

a. "The operability and functional performance of the components" of the circuits,

b. The operability of the circuits as whole systems, and

c. "Under conditions as close to design as practical, the full operation sequence that brings the system into operation."

INSERT 8.2-7

The common station service transformers and buses are connected and arranged to provide two physically independent offsite power circuits to the onsite distribution system. One preferred power supply is made up by common station service transformers A and D while the other preferred power supply is made up by common station service transformers B and C.

The two common station service transformers A and B and buses are connected and arranged to provide two physically independent offsite power circuits to the onsite distribution system. Either of these can be used as the preferred power supply. The outdoor portions of the buses are weatherproof and equipped with 120V, 1 phase heaters to maintain the temperature. The conductors are fully insulated with flame-retardant material, bus supports are flame retardant, and the metal enclosures will prevent any arcing fault in one bus from damaging the other bus.

start buses A and B. The normal feeder breaker and the alternate feeder breaker obtain their supply from separate buses and separate common station service transformers, thereby giving each start bus two possible and independent sources of power.

From the feeder breakers of the 6.9-kV unit start board the two 6.9-kV unit start buses A and B and RCP start buses A and B run on separate support structures. These buses are outdoor, nonsegregated, and the conductors are fully insulated with flame-retardant material. At the penetration of the outside building wall, the unit buses are provided with fire- and moisture-resistant barriers. The RCP start buses enter the outdoor metal-clad switchgear and connect to the RCP board supply breakers. These breakers are electrically operated, vertical lift drawout type, with stored energy mechanisms.

INSERT
8.2-8

The 6.9-kV start buses enter the Turbine Building spaced 8'-6" centerline-to-centerline and maintain this spacing through the building. The start buses are tapped at appropriate places and routed to the appropriate supply breakers in the 6.9-kV unit and 6.9-kV common boards. The start buses enter the unit board supply breakers through the top of the boards. The normal supply breaker and alternate supply breaker for each board are separated along the length of the board by several feeder breakers, thereby preventing a fault in one breaker from damaging the alternate supply breaker. All buses are provided with gas-resistant seals at entry to the switchgear.

The power from the unit boards is supplied to the shutdown boards by means of cables routed via separate cable trays and conduits to their respective boards. The minimum distance between trays carrying cables to the redundant shutdown boards is approximately 30 feet, while the trays carrying normal and alternate supplies to the same shutdown board are at a minimum separation of 1 foot. A cable fault relay trips circuit breakers provided at each end of these cables so that even a simultaneous fault of the normal and alternate supply cables to one shutdown board will not effect the offsite power supply to the redundant board.

The normal distribution system to the unit boards and shutdown boards is supplied by the unit station service transformers during plant operation. The common station service transformers are used to supply the power to the unit boards or offsite distribution system during generator startup or shutdown. In case of an emergency or fault of the unit station service transformers, the common station service transformers are immediately available for use as the offsite power system and provides two separate, independent, and redundant circuits to the onsite distribution system.

INSERT 8.2-8

The two common station service transformers C and D are connected by cables and arranged to provide two physically independent offsite circuits (alternates 1 and 2) to the 6900V shutdown boards. The cables for the alternate 1 circuits are routed through separate conduits and cable trays through the turbine building and control building to the shutdown boards. The cables for the alternate 2 circuits are routed through separate conduits and cable trays alongside the exterior of the turbine building, across the top of the control building, and then enter the top of the auxiliary building and drop down to the shutdown boards.