TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

January 17, 1984

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

Dear Ms. Adensam:

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

On October 24, 1983, TVA received informal information from the NRC concerning Watts Bar Nuclear Plant (WBN). This information consisted of a copy of the NRC Power Systems Branch (PSB) status list and NRC concerns related to open and confirmatory items and license conditions as specified in the WBN Safety Evaluation Report.

Enclosure 1 is TVA's understanding of the status of each of the PSB items as a result of telephone conference calls conducted on October 27 and November 1, 1983.

Enclosure 2 provides a statement of the NRC concerns provided on October 24, 1983 and a statement of TVA or NRC action as a result of the subject conference calls.

TVA was also requested to provide a statement of compliance with license conditions 13, 14, 15, 16, and 17. This information is provided in enclosure 3. Please note that for safety reasons TVA does not concur with license condition 17.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 17th day of January 1984

Paulette H. White
Notary Public
My Commission Expires 9-5-84

Enclosures (3)
cc: U.S. Nuclear Regulatory Commission (Enclosures)
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 2900
Atlanta, Georgia 30303

B001
1/1

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
NRC POWER SYSTEMS BRANCH REVIEW ITEMS
NRC SPECIFIED STATUS AS OF NOVEMBER 1, 1983

1. Availability of offsite circuits (section 8.2.2.1, Confirmatory Item 26 - CLOSED).

2. Minimizing the probability of losing all AC power (section 8.2.2.2, Open Item 11 - CLOSED).

3. Capability for testing auto transfer of offsite power among the various sources (section 8.2.2.2, Open Item 11 - CLOSED).

4. Automatic transfer of power sources on degraded voltage (section 8.2.2.3, New Item 1 - OPEN).

5. Independence of offsite circuits between common station service transformers and class 1E buses (section 8.2.2.4, New Item 2 - OPEN).

6. Control power for the common station service transformer and switchgear C and D (section 8.2.2.5, New Item 3 - OPEN).

7. Nonsafety loads powered from the class 1E a-c distribution system (section 8.3.1.1, Confirmatory Item 27 - CLOSED).

8. Low and/or degraded grid voltage condition (section 8.3.1.2, Confirmatory Item 28 - CLOSED).

9. Compliance with guidelines of IEEE-1977 (section 8.3.1.6, License Condition 12 - CLOSED).

10. Diesel generator reliability qualification testing (section 8.3.1.6, Confirmatory Item 29 - CLOSED).

11. DC system monitoring and annunciation of the 125 V DC diesel generator battery system (section 8.3.2.2, License Condition 13 - OPEN).

12. Diesel generator battery system (section 8.3.2.4, Confirmatory Item 30 - CLOSED).

13. Thermal overload protective bypass (section 8.3.3.1.2, Confirmatory Item 31 - CLOSED).

14. Sharing of a-c distribution systems and standby power supplied between units 1 and 2 (section 8.3.3.2.2, Confirmatory Item 32 - OPEN).

15. Sharing of raceway systems between units (section 8.3.3.2.3, Confirmatory Item 33 - CLOSED).

16. Sharing of d-c loads between units 1 and 2 (section 8.3.3.2.4, License Condition 14 - OPEN).

17. Physical identification of electrical cables (section 8.3.3.3 (1) - CLOSED).

18. Associated circuits (section 8.3.3.3 (2), License Condition 15 - OPEN).

19. Separation between class 1E and nonclass 1E cables (section 8.3.3.3 (3), License Condition 16 - OPEN).

20. TMI item II.G.1, "Emergency Power for Pressurizer Equipment" (section 8.3.3.4, License Condition 17 - OPEN).

21. Testing of 1-of-2 class 1E power systems versus 1-of-4 systems (section 8.3.3.5.2, Confirmatory Item 34 - CLOSED).

22. Reactor Coolant Pump breakers (section 8.3.3.6, License Condition 18 - CLOSED).

23. Compliance with position 1 of Regulatory Guide 1.63 (section 8.3.3.6, Confirmatory Item 35 - OPEN).

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2

The following NRC concerns and actions required for resolution are specified by the number corresponding to the listing of enclosure 1.

4. Automatic Transfer of Power Sources on Degraded Voltage - SER Section 8.2.2.3 - New Item 1

   Section 8.2.2 of the FSAR states that on a degraded voltage condition for the 6.9 kv shutdown board (Class 1E bus) offsite power is automatically transferred from the normal to the first alternate to the second alternate to the onsite diesel generator source. The same section of the FSAR also states in contradiction that on degraded voltage offsite power is only transferred from the normal to the diesel generator source. Clarification of the contradiction and justification of the design will be pursued with the applicant and the results will be reported in a supplement to the SER.

   The following information was provided in support of the NRC's concerns:

   Description of Circumstances

   The Monticello generating station was operating at 100-percent power on August 1, 1983. At about 4:00 am, the plant was being operated at reduced main generator terminal voltage (20.9 kv vs. nominal of 22.0 kv) in response to the load dispatcher's request (to lower transmission line reactive load due to light grid loads). The switchyard/grid voltage was therefore only 344 kv (vs. nominal of 355 kv). The essential safety-related 4160v buses were powered by the main generator output, via the unit auxiliary transformer, and consequently were at only 3960v.

   When a large safety-related pump on one of the two redundant 4160v buses was started, the bus voltage dipped below the 3885v trip setpoint for the degraded voltage protection system. When the bus voltage returned to steady state, the voltage was not high enough to reach the reset setpoint of the degraded voltage protection relays. Therefore, after the prescribed 10-second time delay, the degraded voltage protection system actuated and tripped the offsite power feeder breaker to that division of the Class 1E power distribution system.

This also started the emergency diesel generator (EDG) which picked up the bus loads which were not automatically shed. The redundant Class 1E power division remained on the unit auxiliary transformer throughout the event.

Investigation of this operating event by the NRC revealed three items which could be applicable to other nuclear power plants:

1. The licensee had previously submitted analysis to support the adequacy of the design of the station electric distribution system. In this analysis, the worst-case minimum grid voltages were assumed

to be 350.8 kv and 119.7 kv (under heavy load conditions), and the minimum voltage on the safety-related 4160v buses was calculated to be 4025v after all safety-related loads were started and running. However, during light load conditions, the switchyard/grid was intentionally being operated at 344 kv (the voltage level on the 115 kv grid is unknown) and the 4160v buses were consequently significantly below the minimum voltage that had been analyzed. Further, such reduced voltage situations were not rare occurrences that were caused by factors outside the control of the licensee, but rather were routine operating conditions. As demonstrated by this event, these operating conditions significantly reduced the reliability of offsite power and caused the station's power distribution system to be incapable of performing its safety function without reliance on the onsite emergency power sources.

2. Before the event, the licensee had not appreciated the fact that the point at which the degraded voltage relays would reset is significantly above the drop-out setpoint. In this case the drop-out setpoint is 3885v and the reset occurs at about 3985v --- an offset of 100v. In order to avoid actuating the degraded voltage protection system, voltage dips from motor starting transients must recover (within the prescribed time delay) such that the bus voltage returns to a value above the reset value plus any uncertainties and/or tolerances involved.

3. At Monticello, when a degraded voltage is sensed on any one of the sources of offsite power, the bus is transferred directly to the emergency onsite power sources (even if another offsite source is available). This situation is undesirable, since the cause of the degradation could be equipment related to only one offsite power circuit and an alternate offsite circuit might be available. A design that inherently precludes access to alternate sources of offsite power is not consistent with the design objective of providing redundant access circuits for offsite power.

Action

TVA provided additional clarification of the WBN design during telephone conference calls of October 27 and November 1, 1983. As a result of this discussion, the NRC will reconsider closure of this item.

5. Independence of Offsite Circuits Between Common Station Service Transformer and Class 1E System (SER Section 8.2.2.4) - New Item 2

The offsite power circuits are routed from the Watts Bar hydro 161 kv switchyard by separate overhead transmission lines to separate station service transformers. This design meets GDC 17 and is acceptable.

However, the routing of offsite circuits is through a common raceway system from the separate transformers to the redundant Class 1E distribution system as documented in section 8.2.1.8 of the FSAR. It appears that adequate independence of offsite circuits, in accordance with the requirements of GDC 17, has not been provided in the new design. This item will be pursued with the applicant and the results will be reported in a supplement to this report.

Action

As a result of discussions between TVA and the NRC on October 27, 1983 and November 1, 1983, TVA revised FSAR pages 8.2-13, 8.2-14 and 8.2-14a in Amendment 49.

6. Control Power for Common Station Service Transformers and Switchgear C and D - (SER Section 8.2.2.5) - New Item 3

Section 8.2.1.6 indicates that control power is provided by a 125 Vdc supply for station service transformers and switchgear C and D control. Information as to the physical and electrical separation and location of the 125 Vdc source has not been described or analyzed in the FSAR. This item will be pursued with the applicant and the results will be reported in a supplement to the SER.

Action

As a result of discussions between TVA and the NRC on October 27, 1983 and November 1, 1983, TVA revised FSAR pages 8.2-10 and 8.2-16 in Amendment 49.

14. Sharing of AC Distribution Systems and Standby Power Supplies Between Units 1 and 2 - (SER Section 8.3.3.2.2) - Confirmatory Item 32

In the SER, the staff indicated that sharing of AC distribution systems and standby power supplies was acceptable pending revision of the FSAR that reflects requirements of the shared safety systems.

By amendment 48 to the FSAR, the applicant (page 8.3-26 partially documented the description and analysis presented in their January 7, 1982 letter. This item remains confirmatory pending documentation of the remaining part of the description and analysis in the FSAR.

Action

Based on discussions with the NRC on October 27, 1983 and November 1, 1983, TVA will revise the FSAR to include the required information. Copies of amended FSAR pages 8.1-11 and 8.3-26a with those revisions are attached.

22. Reactor Coolant Pump Breakers - (SER Section 8.3.3.6) - License Condition 18

In the SER the staff required as a condition to the license, that redundant fault current protective devices be provided in series for the reactor coolant pump circuits in accordance with position 1 of Regulatory Guide 1.63. By amendment 48 to the FSAR the applicant documented that the design for reactor coolant pump penetration protection would contain the required redundant circuit breakers. The proposed design meets position 1 of Regulatory Guide 1.63 and is acceptable. This item is therefore resolved and is no longer a license condition.

Action

We understand that the above or similar wording will be included, by NRC, in supplement 2 to the SER.

23. Compliance with Regulatory Guide 1.63 - (SER section 8.15)

The staff required a reevaluation of the penetrations capability to withstand, without seal failure, the total range of available time-current characteristics assuming a single failure of any overcurrent protective device. By amendment 48 to the FSAR the applicant documented the results of their reevaluation. Based on these results, the staff concludes that all circuits (Class 1E, non-Class 1E, normally energized and normally deenergized) that pass through containment electric penetrations have been designed with the required capability and contain the required primary and backup protective devices (except low energy instrument circuits), and are therefore, acceptable with the following exceptions:

a. 480-volt circuits shown on figures 8.1-5 through 8.1-7 of the FSAR use cable protectors. It appears, for example, that 4/0 copper cable is used as the protective device or fuse. Clarification of this item will be pursued with the applicant.

Action

This concern was discussed with the NRC on October 27, 1983 and the NRC indicated the matter was resolved.

b. The circuit shown on figure 8.1-5 of the FSAR appears to not have the required primary and backup protective devices, clarification of this item will be pursued with the applicant.

Action

TVA provided additional clarification of protective device design and the NRC indicated that this matter was resolved.

c. Section 8.1.5.3 of the FSAR implies that low voltage control circuits (that do not have sufficient fault currents available to damage a penetration) do not have the required primary and backup protective devices. Test and analysis to demonstrate that the subject control circuits cannot generate sufficient fault current to damage a penetration has not been provided. This item will be pursued with the applicant.

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
SPECIFIC NRC POWER SYSTEMS BRANCH CONCERNS

Action

As a result of discussions with the NRC on October 27, 1983 and November 1, 1983, TVA will revise page 8.1-8 and figures 8.1-5, -6, -7 of the FSAR to address this issue. Copies of the amended FSAR are attached.

ENCLOSURE 3
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2

TVA was requested to provide a statement of compliance to License Conditions 13, 14, 15, 16, and 17. TVA compliance to each of these items is specified below. The numbering system is consistent with enclosure 1.

11. License Condition 13 has been fully satisfied. See FSAR section 8.3.1.1 "Diesel Generator Control Power."

16. License Condition 14 has been resolved as described below:

All possible interconnections between redundant divisions through normal and alternate power sources are identified in FSAR Tables 8.3-9 and 8.3-10. For those interconnections identified in FSAR Table 8.3-9 (control power for 6.9 kV and 480 V switchgear) the staff agreed (see SER section 8.3.3.2.4) that an administrative procedure that requires verification of correct alignment every seven days rather than being verified immediately by alarm as required by the staff position in SER section 8.3.1.7 is adequate. Therefore, this license condition has been satisfied.

18. License Condition 15 has been resolved as described below:

In a telecon with the NRC staff following the June 1982 site visit, it was agreed that testing of the protective device was not required if TVA could show by analysis that a circuit breaker and a fuse in series or two circuit breakers in series have a reliability equivalent to a circuit breaker periodically tested.

This analysis was performed and is documented by Appendices 8C and 8E in the FSAR and submitted by Amendment 48. The Appendix 8C analysis verified that the protective devices for cables in associated circuits will clear electrical faults in an acceptable time without exceeding the I^2t rating for the cable. The Appendix 8E analysis concluded that each of the following protective schemes provides cable protection which is at least as reliable as a single circuit breaker with periodic testing: (1) a circuit breaker and a fuse in series, (2) two circuit breakers in series, or (3) a single fuse. Therefore, these analyses demonstrate that electrical faults on associated circuits will not compromise the independence of the redundant Class 1E cable systems and that periodic testing of these three protective schemes is not required.

The protective device of the 160 associated circuits either have or are being modified to have one of the above protective schemes. The circuit breakers are of a quality commensurate with their importance to safety.

Therefore, this license condition has been satisfied.

19. License Condition 16 has been resolved as described below:

In a telecon with the NRC staff following the June 1982 site visit, it was agreed that if TVA could show by analysis that a circuit breaker and a fuse in series or two circuit breakers in series have a reliability equivalent to a circuit breaker periodically tested, that testing of the protective device was not required.

This analysis is documented in Appendix 8E of FSAR Amendment 48. It demonstrates that each of the following protective schemes provides cable protection which is at least as reliable as a single circuit breaker with periodic testing: (1) a circuit breaker and a fuse in series, (2) two circuit breakers in series, or (3) a single fuse. The protective device of nonClass 1E circuits that are routed closer to Class 1E circuits than allowed by Regulatory Guide 1.75 have been identified and will be periodically tested, except those that have one of the above protective schemes.

The circuit breakers are of a quality commensurate with their importance to safety.

Therefore, this license condition has been satisfied.

20. TVA does not comply with license condition 17 as stated in the SER. License condition 17 requires that each PORV and its associated block valve be powered from the same power train. However, TVA disagrees with that position for safety reasons. By letter dated June 9, 1983 from D. S. Kammer to E. Adensam, TVA provided the basis for powering the PORV and associated block valve from opposite power trains and why that design complies with NUREG-0737, II.G.1. As of this date, NRC has not responded to that information. We reaffirm our position, as described in the referenced letter, that the present TVA design provides the highest degree of safety possible and is in full compliance with NUREG-0737, II.G.1.

8.3.1.2 Analysis

8.3.1.2.1 Standby A.C. Power Systems

The Standby A.C. Power System is designed to comply with the requirements set forth in GDC 17 and 18. The design also conforms with Regulatory Guides 1.6 and 1.9 and IEEE Std 308-1971. The following paragraphs discuss each of the requirements.

Capacity, Capability, and Margin

General Design Criteria 17

The standby a.c. power system is designed to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences, and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents. 49

Regulatory Guide 1.9

Each diesel generator set is capable of starting and accelerating to rated speed, in the required sequence, all the needed engineered safety feature and shutdown loads. At no time during the loading sequence does frequency or voltage decrease to less than 95 percent of nominal and 75 percent of nominal, respectively. During recovery from transients caused by step load

IEEE Trial-Use Std 338-1971, 'Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems.' (F) 50

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

IEEE Std 387-1977, 'Criteria for Diesel Generator Units Applied
as Standby Power Supplies for Nuclear Power Stations.' (See 50
Appendix 8D).

Notes:

1. RG-1.63 48

C.1 Full Compliance: The electric penetrations have been
designed to withstand the maximum fault current for the time 46
duration of the backup protective device. A redundant overcurrent protection system is provided (a breaker and a fuse/breaker) for all penetrations except instrumentation circuits where fault current is not a problem.

The only 6.9 kV circuit feeding loads inside the containment are for the reactor coolant pumps (RCP). The breaker used for control of the RCPs is backed up by a second breaker to provide the redundant overcurrent protection system required by RG-1.63. The breakers are each provided with independent d.c. control power from different batteries so that failure of either battery will not violate the single failure criteria. Provisions for testing are 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 46
duration 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. 50

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 combination was 50
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.

Low-voltage control circuits have a molded case breaker or a 50
fuse backed up by a fuse. The penetration withstands the
available fault current vs. time duration for 48

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. 46

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, 50 (i.e. 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.

RG-1.81
Position 2

a. Watts Bar is a two-unit plant.

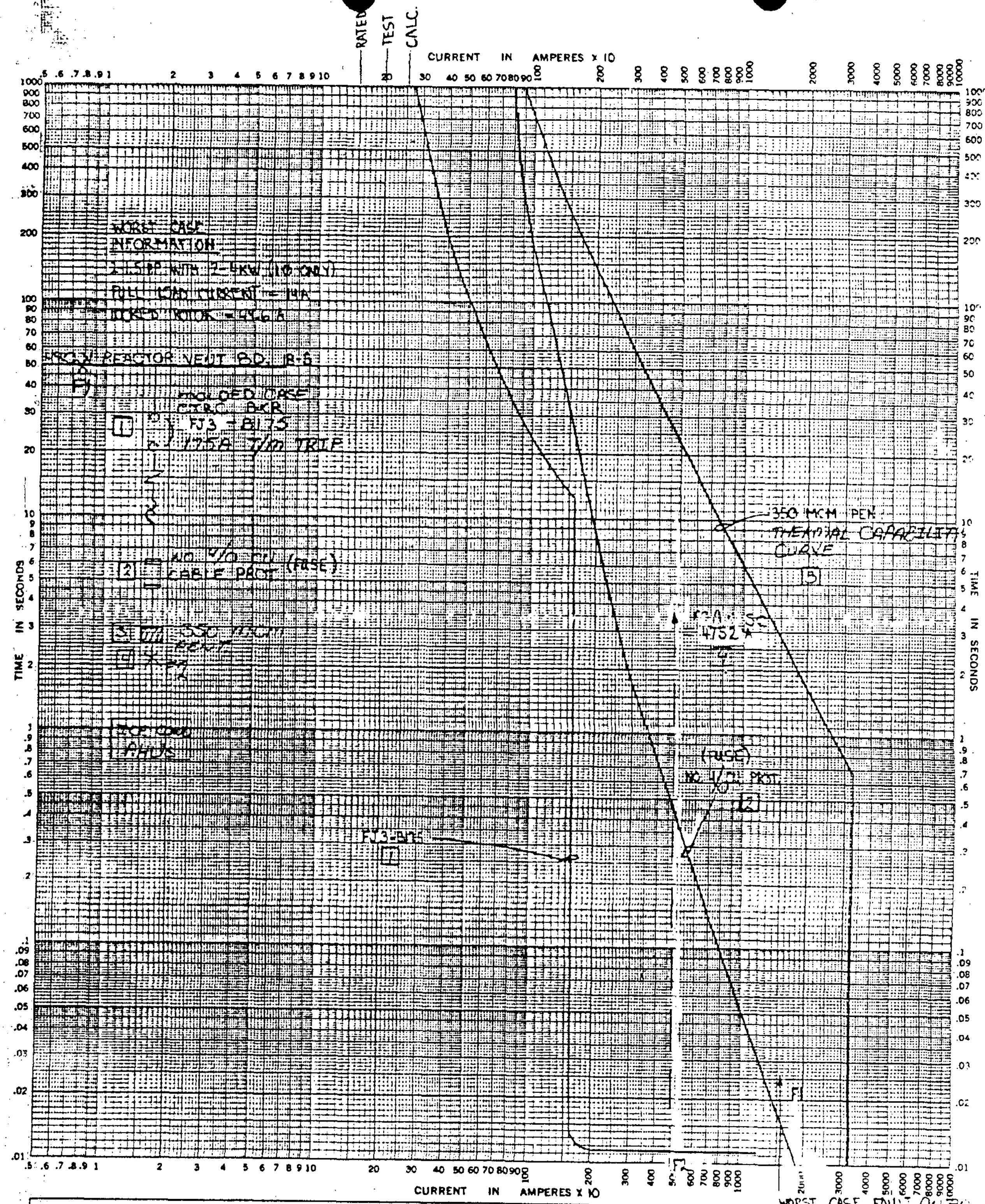
b. With a single failure (loss of a battery or loss of a diesel generator) in the plant sufficient ESF loads are still automatically available to the accident unit and to safety shutdown the remaining unit. The shared safety systems are designed so that one complete header (train) can shutdown one unit with a design basis accident and the other unit with a concurrent full load rejection. For these events, electric motors driving equipment in the shared systems are connected 50 without regard to which unit has initiated the accident signal. Therefore, a spurious accident signal in the nonaccident unit concurrent with an accident in the other unit will not cause a standby power supply to be overloaded.

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. Assuming the loss of offsite power, a design basis accident in one unit, and a full load rejection in the other unit, one division of ESF equipment can be used to bring the plant to a safe and orderly cold shutdown. Therefore, the safe shutdown could be achieved with the complete failure of a power train in one unit or even with the complete failure of the same power train (-A or -B) in both units.

d. The DG units and the onsite 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 a time. With only one DG unit unavailable, this will ensure power is supplied to enough ESF equipment to safety shutdown both units, assuming the loss of offsite power. 50

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)



480 V REACTOR VENT BD 1B-B PNL 13D TIME-CURRENT CHARACTERISTIC CURVES

For ____ Fuse Links. In ____

BASIS FOR DATA Standards ____ Dated ____

1. Tests made at ____ Volts a-c at ____ p-f., starting at 25C with no initial load ____
2. Curves are plotted to ____ Test points so variations should be ____

No. 2
Date ____

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. 48 5258

COMPUTED LNH DATE 8/12/82

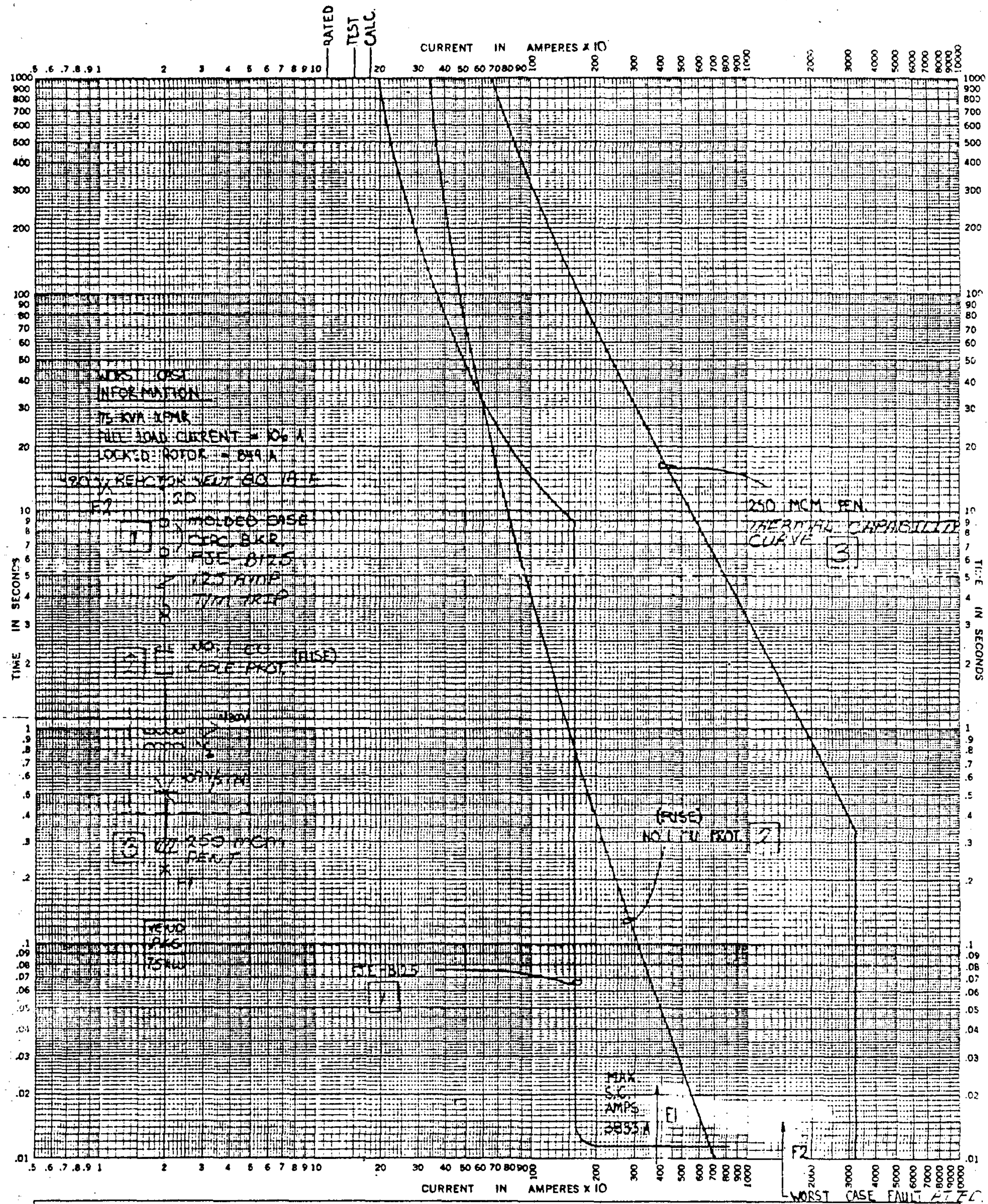
CHECKED [illegible] DATE 10-22-82

SHEET 16 OF 27

IDENTICAL BOARDS

1. REACTOR VENT BD. 1A-B, PANEL 13D
2. REACTOR VENT BD. 2A-A, PANEL 13D
3. REACTOR VENT BD. 2B-B, PANEL 13D

Figure 8.1-5



480 V REACTOR VENT BD 1A-A PNL 2D TIME-CURRENT CHARACTERISTIC CURVES

For ______ Fuse Links. In ______

BASIS FOR DATA Standards ______ Dated ______

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

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

No. 4

Date ______

K-E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. 46 5258

COMPUTED LNH DATE 8/12/82

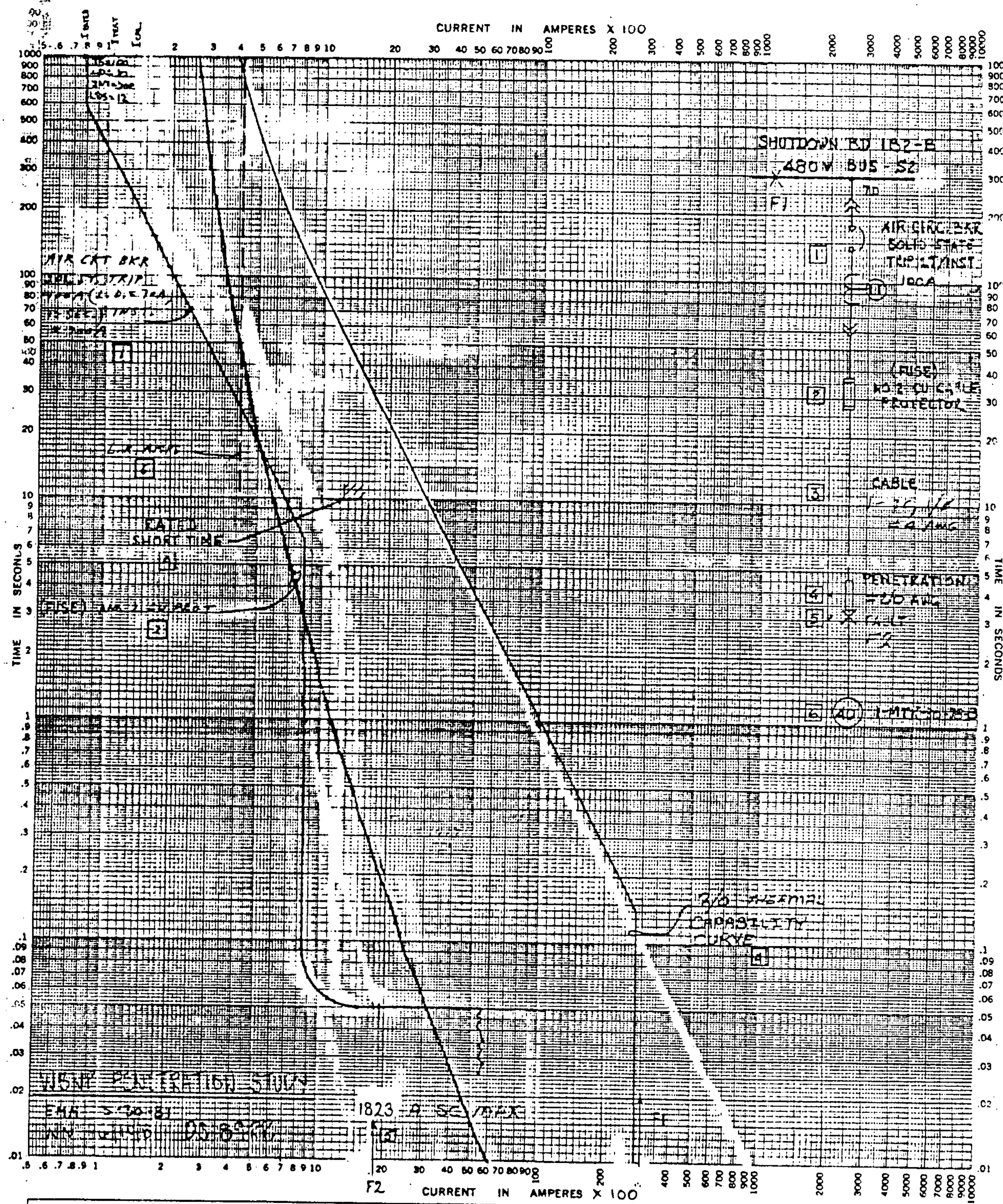
CHECKED MLC DATE 10-22-82

SHEET 18 OF 27

IDENTICAL BOARDS

1. REACTOR VENT BD. 2A-A, PNL 2D

Figure 8.1-6



TIME-CURRENT CHARACTERISTIC CURVES

For ______ Fuse Links. In ______

BASIS FOR DATA Standards ______ Dated ______

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

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

No. 21

Date ______

K+E TIME-CURRENT CHARACTERISTIC 48 5258
KEUFFEL & ESSER CO. MADE IN U.S.A.

COMPUTED LNH DATE 10-22-82

CHECKED MLC DATE 10-23-82

Figure 8.1-7