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JAN 27 1993

U.S. Nuclear Regulatory Commission
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Gentlemen:

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

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - STATION BLACKOUT - SUPPLEMENTAL INFORMATION

This letter provides supplemental information to TVA's letter dated August 31, 1992, for WBN.

In a teleconference on November 19, 1992, with NRC Reviewer A. L. Toalston and NRC's WBN Project Manager, P. S. Tam, TVA provided preliminary responses to NRC's additional questions concerning station blackout. NRC requested that each of the responses be formally submitted for review. The enclosure provides TVA's response to each of those questions as discussed in the teleconference.

If you have any comments concerning this matter, please telephone John Vorees at (615) 365-8819.

Very truly yours,

W. J. Museler

William J. Museler

Enclosure
cc: See page 2

JAN 27 1993

cc (Enclosure):

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ENCLOSURE

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
STATION BLACKOUT
SUPPLEMENTAL INFORMATION

The following questions and responses were informally discussed between NRC and TVA in a teleconference conducted on November 19, 1992. These questions resulted from NRC's review of TVA's Station Blackout (SBO) submittal dated August 31, 1992. The enclosure and page numbers referenced below are from that August 31, 1992 submittal.

ENCLOSURE 1

NRC Question (Page 5)

TVA's submittal does not state that the appropriate SBO procedure(s) provide for opening the Control Room cabinet doors within 30 minutes of an SBO event, in accordance with the guidance described in NUMARC 87-00 (specifically, Supplemental Questions and Answers [Q/A] No. 2.2).

TVA's Response

TVA has analyzed the temperature transient in the Main Control Room for a four-hour SBO. TVA does not expect any thermal-induced equipment failures, even with the cabinet doors closed, for the analyzed SBO transient. However, TVA will revise the relevant SBO procedure for WBN to provide for opening the Control Room cabinet doors within 30 minutes of an SBO event, in accordance with the guidance described in NUMARC 87-00 and Supplemental Q/A No. 2.2.

ENCLOSURE 2

NRC Question (Page 8)

The assumption should not be made that the ac-power is restored from the emergency diesel generators (EDGs). The required coping duration is based on the characteristics of both the onsite and offsite systems. We assume that one or the other, but not necessarily both, are restored. We cannot choose which one. Certainly, the procedures should not be limited to restoring the power only from the EDGs. Both means should be pursued. Are the 250V non-1E station batteries adequate after the four hours for the switching operations required to restore the power from the switchyard?

TVA's Response

The simplifying assumption of using only the EDGs for restoration of ac-power at the end of the SBO event was used in the August 31, 1992 submittal. This assumption was made in order to simplify the guidance to the operators. The design at WBN provides each EDG with a dedicated battery system to supply the required control power for its associated EDG independent of the other EDGs

TVA's Response (Continued)

(see FSAR, Section 8.3.1.1, Diesel Generator Control Power). This configuration provides a reliable and independent control power source for each of the EDGs during SBO conditions and is the preferred analyzed source for restoration of ac-power by the EDGs. However, the WBN SBO recovery procedures will not be limited to restoring power only from the EDGs. The WBN SBO ac-power recovery procedures will be revised to allow the operators to attempt to restore power from the EDGs or from the switchyard, if necessary.

As noted in the WBN SBO submittal, no credit is taken for restoration of ac-power from the switchyard; thus, there are no required loads to consider for the non-vital 250V station batteries. As noted above, however, the WBN SBO ac-power restoration procedures will allow the operators to attempt to restore power from either the EDGs or the switchyard/offsite power sources. TVA is currently in the process of replacing WBN's 250V batteries and has prepared a supporting analysis that includes an evaluation for SBO. This analysis confirms that the replacement batteries have sufficient capacity, providing implementation of load shedding procedures, to perform any needed control functions for restoration of offsite power after four hours.

NRC Question (Page 12)

TVA's determination of a Severe Weather (SW)2 classification is based on transmission lines on multiple right-of-ways (R/W). However, the preferred power (two 161-kV lines) to the safety buses is by a single R/W from the WBN Hydro Switchyard (Page 14). It appears that these lines might be separated by less than one-quarter mile at one mile from the plant. Thus, b = 72.3 (NUMARC 87-00, Part 1C, Q/A No. 22) which results in an SW3, P2 classification that would require an eight-hour coping duration. TVA needs to supply additional justification for an SW2 classification.

TVA's Response

As indicated in the WBN FSAR, Amendment 71 to Section 8.2.1.1, preferred power is supplied from the existing WBN Hydro 161-kV Switchyard by two 161-kV overhead lines, each approximately 1.5 miles long. These two transmission lines are supported on separate towers, and the minimum separation of the two lines is sufficient to ensure that the failure of any tower in one line will not endanger the other line.

TVA's Response (Continued)

NUMARC 87-00, Q/A 22, indicates it was agreed that a plant would be justified in using 12.5 as the "b" factor if the transmission lines were separated by at least one-quarter mile, commencing at a point one mile from the plant. It also states that plants may rely on alternate criteria to justify use to the 12.5 "b" factor, but the criteria may be subject to staff review. TVA believes that the WBN preferred-power-supplies arrangement meets the NUMARC criterion. The intent of NUMARC's separation criteria is to minimize the "window of vulnerability" for a single event to adversely impact the multiple right-of-ways. This limited "window of vulnerability" is provided by the configuration of the WBN right-of-ways.

At WBN, the incoming preferred power sources enter the switchyard from essentially opposite directions and at least one-quarter mile separation is achieved immediately. This one-quarter mile separation is maintained for approximately the first three-quarters of a mile from the nuclear plant's switchyard. At this point, approximately three-quarters mile from the plant, the two separate incoming preferred power sources converge at TVA's Steam Plant site. The one-quarter mile separation is not maintained for the run between the steam and hydro plants; however, this run is less than three-quarters of one mile. At the hydro switchyard, multiple right-of-ways diverge into three separate directions. The WBN design is effectively equivalent, but inverse, to the more typical right-of-way arrangements envisioned by NUMARC. Again, TVA notes that the real concern, a vulnerability to a common-mode failure of the preferred power sources due to the proximity of one another is as limited for the WBN configuration as it is for the configuration described by NUMARC.

A proposed FSAR Figure which depicts the layout of the 161-kV line associated with the preferred power at WBN is attached as Exhibit 1 for additional clarification.

NRC Question (Page 14)

TVA's submittal states that the normal source of power is not from the unit. This contradicts FSAR 8.2-15, 16a, and 18. Explain.

TVA's Response

FSAR Amendment 71 to Section 8.2 of the FSAR was issued on August 5, 1992, to describe the modifications made to the WBN electrical system involving the Common Station Service Transformers (CSSTs). Amendment 71 describes the

TVA's Response (Continued)

offsite power feeds into the WBN plant and indicates that the normal source of power is NOT from the unit boards but from the 161-kV lines. The description provided in the SBO submittal is also correct.

NRC Question (Page 20)

(a) The submittal (Appendix A) indicates that numerous loads will be shed from the batteries at 30 minutes. How many breaker operations will be required? How long will they take?

(b) If a breaker fails to open, will the procedures be framed in a manner to allow the operator to continue the load shedding?

TVA's Response

(a) As indicated in TVA's submittal of August 31, 1992, Appendix A, Tables 1 through 12, there are approximately 121 individual breakers to open for shedding miscellaneous loads. These breakers are grouped in various panels located in the battery board rooms. In addition, there are four lighting panels located in the shutdown board rooms that require several breaker manipulations for load shedding. These rooms are easily accessible and in close proximity of the Main Control Room. Assuming that each breaker in a panel is opened in one to four seconds and verified open in one to four seconds, these actions are conservatively assumed to take the operators about eight seconds per breaker. Operations personnel estimate that this activity can be completed in approximately 20 minutes. Note that credit for this load shedding of the vital batteries is not taken until 30 minutes into the SBO event.

(b) Although the SBO scenario does not require the assumption of any additional single failures, the WBN SBO procedures will be framed in such a manner as to allow the operator(s) to continue load shedding, should an individual breaker fail to open.

NRC Question (Page 20)

The submittal indicates the temperature correction and aging factors used in the battery calculations but does not indicate the margin. Provide the margins for the vital batteries.

TVA's Response

The WBN 125V vital batteries were originally sized using a design margin (cells actual minus cells required/cells required) of 13.4 percent and an aging factor of 1.25, plus a temperature correction factor of 1.11. NUMARC 87-00 references IEEE-STD-485, "IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations," as a suitable methodology to determine the dc-power requirements for SBO. NUMARC 87-00 specifically limits its discussion of margins to aging and temperature corrections. WBN has appropriately accounted for the recommended IEEE-485 aging and temperature "margins" in the SBO dc loading calculation. Additional margin is not explicitly addressed in this calculation. It is TVA's position that additional design margin is not appropriate or required by IEEE-485 for this application. The IEEE standard is written for the purpose of sizing batteries during the design phase. Additional design margin of 10-15 percent is recommended to accommodate load growth. This prudent design practice limits the necessity of premature and costly battery upgrades to accommodate minor load additions. The battery loading for SBO is controlled by the manual shedding of unnecessary loads and the retention of safety and desirable loads, e.g., additional lighting and instrumentation. As such, any future load growth can be accommodated by revisiting the load shedding list. The philosophy utilized at WBN was to provide the operator with as many desirable loads as practicable while maintaining a load profile within the battery's capabilities for the design life of the battery and at worst-case temperature conditions. The SBO evaluation, therefore, determined that for a battery with 15.0 positive plates, a maximum of approximately 325 amperes is possible for the time period of 30 minutes to 4 hours. Based on this determination, the worst-case battery has a loading of approximately 321 amperes for this time period while assuming the 105V dc minimum voltage. However, additional margin is implicitly provided in the WBN SBO dc loading calculation of record by the conservative methodology utilized in calculating the dc load.

A three-interval-step function was used to characterize the load profile. The time intervals for these steps were 0 to 1 minute, 1 to 30 minutes, and 30 minutes to 4 hours. The actual load on the batteries from 0 to 30 minutes involves many intermittent loads and continuous loads that are being shed during this period. Although not quantified, margin is built into the calculation for these first two periods, as the maximum load is assumed to exist continuously during these intervals. TVA has performed a preliminary evaluation to quantify the margin provided in the third step of the load profile for the purposes of this response. In this third step, the current being drawn from the battery was based on the minimum design voltage of

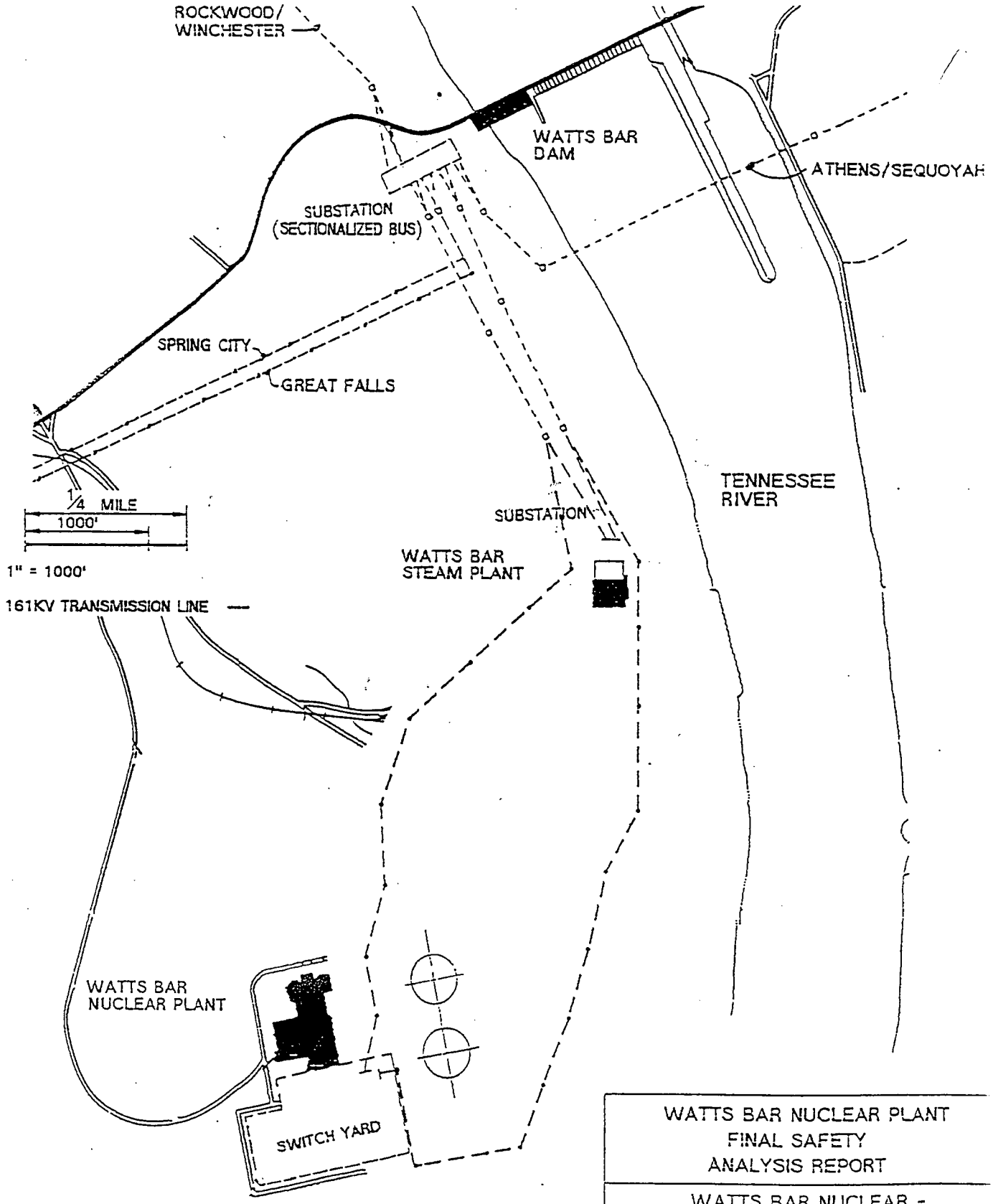
TVA's Response (Continued)

105V dc. This minimum voltage was used conservatively to calculate the load on the batteries. TVA has investigated breaking this third step into smaller time intervals to more realistically match the expected voltage for a particular interval and, thus, to better estimate the demand on the battery.

The currents calculated by this worst-case investigation, using the expected average voltage levels, are shown in Exhibit 2. From these results, the number of positive plates required based on the IEEE-485 worksheet is 13.97. Applying the following formula: cells actual minus the cells required divided by cells actual (or 15.0 - 13.97/15.0), a design margin of approximately 6.9 percent can be demonstrated.

The results of this investigation demonstrate that margins comparable to that suggested in IEEE-485 for sizing batteries does exist for the anticipated battery loading during an SBO event. TVA does not currently plan to revise the calculation of record to explicitly take credit for this margin. Based on this demonstration, it can be seen that the batteries at WBN do have adequate margins to accommodate a limited number of unexpected load perturbations during an SBO event. Some assurance of this capability is believed to be NRC's concern regarding margin, and the implicit margin provided in the WBN calculation should adequately resolve this concern.

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
STATION BLACKOUT
EXHIBIT 1

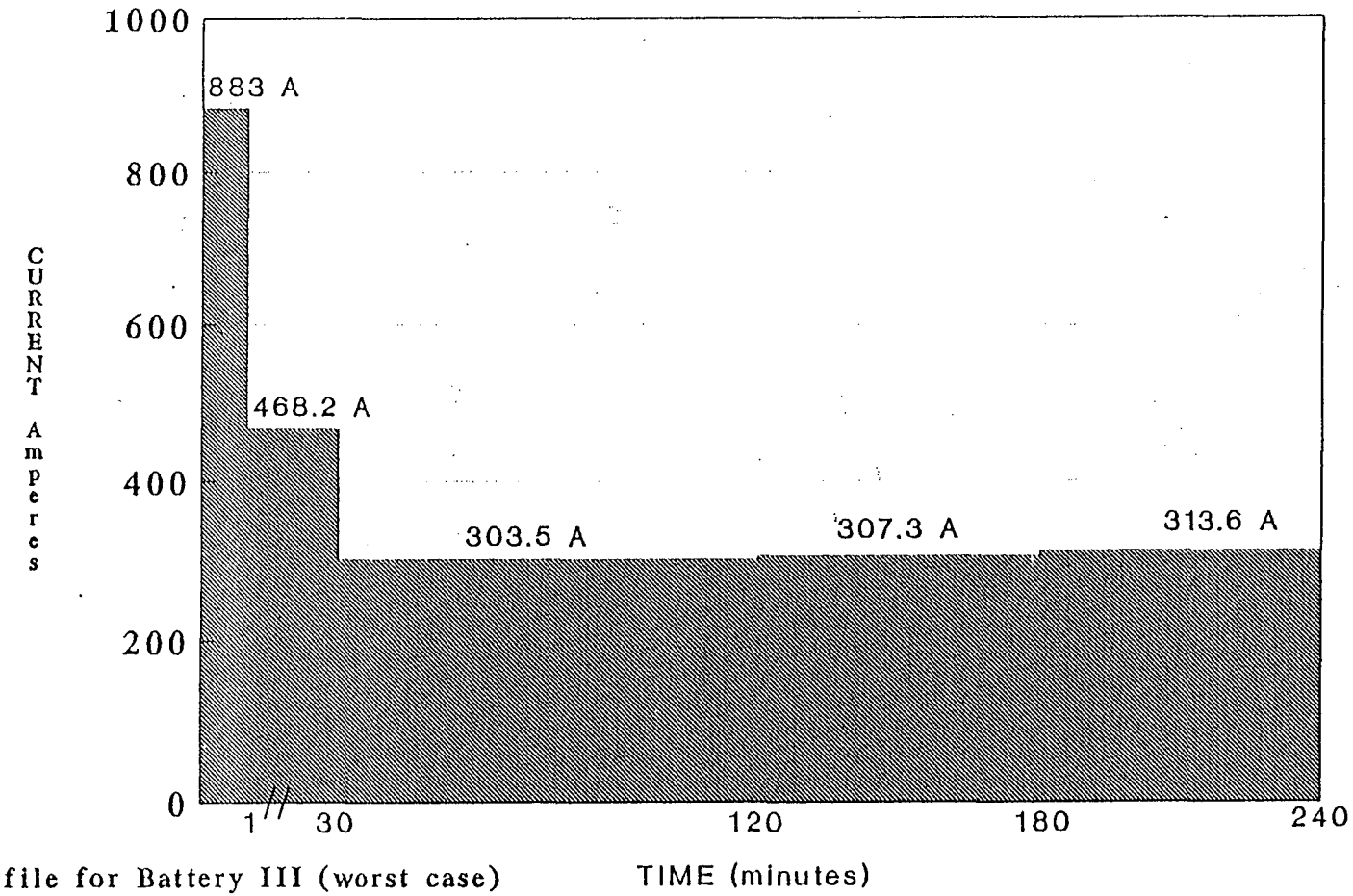


WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

WATTS BAR NUCLEAR -
WATTS BAR HYDRO
161KV LINE ROUTING
Proposed FIGURE 8.2-2A

125 VDC VITAL BATTERY LOAD PROFILE

FIGURE 1



Profile for Battery III (worst case)