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TECHNICAL EVALUATION REPORT ON THE 120 VAC VITAL
INSTRUMENT BUSES AND INVERTER TECHNICAL
SPECIFICATIONS ISSUE B71

MASTER

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ABSTRACT

The operation of a Pressurized Water Reactor (PWR) with one of its 120 Vac vital buses energized in an off-normal mode was analyzed. A Probabilistic Risk Assessment was made to determine the increment of risk by energizing a vital bus from an off-site source directly vs energizing it from its normal, uninterruptible source (i.e., a battery/inverter arrangement). The calculations were made based on uninterruptible source energized vital buses as the *normal mode*.

The analysis indicated that a reduction in the incremental risk increase (caused by plant operation with a vital bus being energized in an off-normal mode) can be accomplished by limiting the time permitted in that condition. Currently, the time that a vital bus can be energized in the off-normal mode is not universally time-limited by plant Technical Specifications. Several alternatives for the reduction in incremental risk were examined and their value/impacts were derived. These data indicate that a recommendation be made for a Technical Specification time limitation of 72 hours per year for off-normal energizing a vital bus during operation of a PWR.

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1. INTRODUCTION

The 120 Vac vital* instrument buses are important to Pressurized Water Reactors (PWRs) because they provide power for the Engineered Safety Features (ESFs), Reactor Protection Systems (RPS), and instrumentation and control systems. Vital buses are designed to provide continuous power during postulated events that involve the loss of normal off-site power sources. Normally, the vital instrument buses are continuously energized by a battery/inverter arrangement. This arrangement provides an Uninterruptible Power Source (UPS) which will energize the bus until transfer to an alternate source is made. Off-site power sources to the vital buses are considered to be Interruptible Power Sources (IPS).

An NRC evaluation of the designs of PWRs and their operating experiences indicates that the 120 Vac vital buses in some plants are energized directly from the off-site power source for long periods of time, rather than from the battery/inverter combination. Thus, vital buses at these plants are being energized by an interruptible power supply during these time periods. Existing plant Technical Specifications generally do not limit the time that these 120 Vac vital buses are energized from an IPS.

*Vital bus as used in this report is referenced from the Code of Federal Regulation 10CFR (Ref 1) Part 50, Appendix A, General Design Criteria 13, 17, and 23, and through Regulatory Guide 1.70 (Ref. 2), part 8.3.1.4 referring to IEEE Standard 308 (Ref 3). Although no specific definition or requirements are given, the Vital Instrument and Control System is a sub-set of the Class 1E power system. The vital system's general requirement is for dependable power supplies for instrumentation and control systems of the unit(s) including instrumentation and control for the reactor protection system and for the engineered safety features systems.

Energizing the vital buses from an Interruptible Power Supply (IPS) may result in the ESF systems not performing their functions when required, and may not meet the single failure criterion. Therefore, placing limitations on the time that a vital bus is energized from an IPS should improve plant safety.

This study is restricted to those vital buses which are normally energized by a UPS, and to PWRs. This study is also restricted to a vital bus energized from a UPS during plant operations (operational modes 1 through 4), except for cold shutdown and refueling.

2. BACKGROUND

It was noted in a memorandum from Carlyle Michelson (Director, Office for Analysis and Evaluation of Operational Data) to Harold R. Denton (Director, Nuclear Reactor Regulation) (Ref. 4), that Licensee Event Reports (LERs) for Rancho Seco and Oconee 3 indicated that a vital bus, normally energized by the UPS, was energized directly from off-site power, an IPS. Both LERs indicated that some ESF functions could be inhibited if the off-site power to this vital bus were lost and an additional vital bus were lost concurrently (single failure criterion). Although no transient had occurred at either plant, Reference 4 indicated that there were no Limiting Conditions of Operation (LCO) to restrict the time that a 120 Vac vital bus may be removed from the UPS.

Vital instrument buses for PWRs are normally energized by UPSs, such as battery charger/battery/inverter arrangements. A scenario could exist in which one of the inverters is out of service and its associated vital bus is energized by an off-site source which experiences a loss of voltage. This situation, coupled with a single failure of another inverter, could produce the condition of two vital buses out of service. This in turn could increase the probability of a major occurrence. In some plants, de-energizing two vital buses will cause spurious actuation of some ESF functions and in other plants will inhibit some ESF functions.

3. PROPOSED ACTION

It is recommended that in a PWR plant, a 120 Vac vital instrument bus (which is normally energized by a UPS) have a Technical Specification time restriction when that bus is energized by an IPS. Such a vital bus should be allowed to be energized from an IPS for up to 72 hours per year. If the vital bus can not then be energized from a UPS, it is recommended that the licensee follow the Action Statement in the Technical Specifications for the plant not meeting a Limiting Condition of Operation, i.e., the plant should be in Hot Standby within the next 6 hours and in Cold Shutdown within the following 30 hours.

4. TECHNICAL APPROACH

A Probabilistic Risk Assessment (PRA) was made to determine the incremental risk of energizing one vital bus from an IPS, as opposed to the normal mode of energizing from a UPS. The incremental risk may be used to determine time limitations for this condition. It was assumed that all 120 Vac vital buses were normally energized by a static inverter (the UPS arrangement), and that the abnormal condition has one vital bus energized from off-site power (the IPS arrangement). Calculations were made for an upper bound incremental risk using probabilities and failure rate estimates which were given in and/or derived from WASH 1400 (Reactor Safety Study, Ref. 5). Had computer codes been used, the incremental risk could be refined and the importance of each individual event to the overall scenario be more clearly determined.

Although WASH 1400 did not specifically look at the scenario of loss of off-site power when a 120 Vac vital bus is being energized from either an IPS or a UPS, the incremental risk calculated using the data from WASH 1400 is a measure of the importance of the scenario hypothesized. The WASH 1400 study was for a plant that had two inverter-energized vital buses and two vital buses energized from off-site sources through regulators.

Risk is defined as consequences times probability. In this case, the consequences of loss of a 120 Vac vital bus were assumed to be those associated with release categories* PWR-1, PWR-2, and PWR-6 of WASH 1400 (i.e., core melt, no containment isolation, with insufficient power to ESF equipment as a contributor).

The loss of two 120 Vac vital buses (one on IPS and one on UPS) is assumed to be equated to insufficient power to ESF equipment as defined in WASH 1400 and to result in core melting and no containment isolation (containment failure) from the transient event. The probabilities associated with the loss of a vital bus being energized by either an IPS or a UPS are taken from failure rates provided in WASH 1400. It was assumed that loss of a vital bus does not initiate a LOCA.

The WASH 1400 study listed the "major and dominant" contributors to insufficient power to ESF systems during a LOCA (unavailability per demand). The major and dominant contributors are total loss of both off-site power and emergency diesel generators. The probability of insufficient power to the ESF systems per demand (q) as provided by the WASH 1400 study is 10^{-5} .

The loss of off-site power and of the diesel generators is independent of the loss of a vital bus. Therefore, loss of a vital bus that is being energized by either a UPS or an IPS, which is the subject of this study, has no effect on the dominant contribution ($q = 10^{-5}$) to insufficient power to ESF systems as provided by WASH 1400.

The minor contribution to insufficient power to ESF systems per demand has a total probability on the order of 10^{-7} . The scenario of loss of a vital bus energized by an IPS or a UPS is assumed to be at least one of the contributors to this probability. It is assumed for an upper bound estimate of the risk due to loss of a vital bus that this scenario is the dominant contributor.

*Release categories are defined in WASH 1400, Appendix V, Section 2, and Appendix VI, Section 2.

The probability of the loss of a vital bus when it is energized by a battery/inverter combination (vital bus energized by a UPS) is 1.1×10^{-6} *.

The probability of the loss of a vital bus energized by off-site power (vital bus energized by IPS) is 4.1×10^{-5} **.

Therefore, the total probability for insufficient power to the ESF per demand including loss of a vital bus energized by an IPS (as opposed to its being energized by a UPS) is:

$$q = 10^{-5} + 10^{-7} \times \frac{4.1 \times 10^{-5}}{1.1 \times 10^{-6}}$$

$$q = 1.37 \times 10^{-5}.$$

Including the loss of a vital bus energized by an IPS, as opposed to being energized by a UPS, raises the probability of insufficient power to ESF systems per demand from 1×10^{-5} to 1.37×10^{-5} . The probability of insufficient power to ESF systems per demand with the vital bus energized by an IPS is 1.37×10^{-5} . The probability of insufficient power to ESF systems per demand with the vital bus energized by a UPS is 1.0×10^{-5} .

WASH 1400 has seven PWR release categories which involve core melt, each of which defines time histories and specific fractions of core inventory released from the containment. Each of these release categories is the result of several key accident sequences. Some of the key accident sequences involve electric power. Those release categories which had key accident sequences involving electric power were the only ones used in this study.

The PWR release categories in WASH 1400 that have key accident sequences involving electric power, are PWR-1, PWR-2, and PWR-6. Each key accident sequence in these release categories is a sequence of events. The probability of occurrence for the overall key accident sequence is the multiplication of the probability of occurrence of each event in the sequence.

*From WASH 1400, Appendix II, pg. 205, insufficient power (IP) on vital bus 1-I (battery/inverter system)

**From WASH 1400, Appendix II, pg. 206, IP vital bus 1-III, (directly from off-site source)

This report assumes that the probability of occurrence for the key accident sequences that involve electric power given in WASH 1400 is for a vital bus being energized by a UPS. It is also assumed that the fractional contribution of electric power to the overall probability of occurrence of the key accident sequence is the same as the probability of insufficient power to ESF systems per demand discussed above.

The probabilities of occurrence of key accident sequences that involve electric power (and a vital bus energized by a UPS) are the following for the applicable PWR release categories:

These are Condition 1 probabilities (vital bus always energized by a UPS).

PWR-1	3.0×10^{-8} /reactor-year
PWR-2	2.7×10^{-6} /reactor-year
PWR-6	6.1×10^{-7} /reactor-year

To determine the probability of occurrence of key accident sequences involving electric power (with a vital bus energized by an IPS), the above probabilities were multiplied by $1.37 \times 10^{-5}/1.0 \times 10^{-5}$, or by 1.37. This ratio accounts for the increased probability of insufficient power to ESF systems per demand because a vital bus is energized by an IPS. The probabilities of occurrence of key accident sequences that involve electric power (and vital bus energized by an IPS) are the following for the applicable PWR release categories:

These are Condition 2 probabilities (vital bus always energized by an IPS).

PWR-1	4.1×10^{-8} /reactor-year
PWR-2	3.7×10^{-6} /reactor-year
PWR-6	8.4×10^{-7} /reactor-year

The difference in the above probabilities is the increase in the probability of occurrence of a WASH 1400 release category due to always having a 120 Vac vital bus energized by an IPS. Multiplying the consequences associated with the release category times the difference in the above probabilities of occurrence of that release category gives the increase in risk associated with always having one vital bus on an IPS versus its normal UPS.

Table 1 lists the consequences associated with each PWR release category listed above. The consequences are the man-rem exposure to the population which is based on the fractions of core inventory released as determined in WASH 1400, and a population density of 340/mile². This population density is the mean 50 mile radius population density projected for U.S. power reactors in the year 2000 (Ref. 6). The consequences are taken from Reference 7.

The change in the probability of occurrence given in Table 1 is the difference between the probability of occurrence of key accident sequences which involve electric power with a vital bus always being energized by an IPS versus it always being energized by a UPS. This is the difference between the Condition 2 probabilities (vital bus always energized by IPS) and the Condition 1 probabilities (vital bus always energized by UPS) given above.

The incremental risk given in Table 1 is the estimate of the increase of risk associated with always energizing a vital bus from an IPS, as opposed to always energizing that bus from a UPS. This is also the maximum reduction in the incremental risk associated by requiring a vital bus to always be energized by a UPS.

5. UNCERTAINTIES

In this analysis, the vital bus arrangement was assumed to be three 120 Vac vital buses, all energized by a UPS, and one vital bus energized by either a UPS (Condition 1) or an IPS (Condition 2). This is not true for the Surry plant in WASH 1400 and some other plants (such as Ginna) which have two vital

TABLE 1

Estimated Risk for a Vital Bus Not Being Energized by an Uninterruptible Power Supply (UPS)

<u>Release*</u> <u>Category</u>	<u>Consequences**</u> <u>(man-rem)</u>	<u>Change in Probability</u> <u>of Occurrence***</u>	<u>Risk per year</u> <u>(man-rem)</u>
PWR-1	5.4×10^6	1.1×10^{-8}	.06
PWR-2	4.8×10^6	1.0×10^{-6}	4.8
PWR-6	$.15 \times 10^6$	2.3×10^{-7}	<u>.035</u>
			about 5 man-rem

* WASH 1400, Reference 5.

** Reference 7.

*** Change in probability between a vital bus always on an IPS versus always on a UPS.

buses energized by a UPS and two energized by an IPS (off-site power). In using the probabilities and failure rate estimates from WASH 1400, it was assumed that WASH 1400 was actually based on the vital bus arrangement of all four buses being energized by a UPS.

Correcting WASH 1400 for the fact that it is based on only two vital buses energized by a UPS would lead to smaller probabilities of insufficient power to ESF systems per demand and smaller probabilities of occurrence for key accident sequences which include electric power. However, the loss of a vital bus is not a major and/or dominant contributor to loss of power to ESF systems. Therefore, the overall probabilities of insufficient power to ESF systems per demand and the overall probabilities of key accident sequences involving electric power essentially do not change. The risk given in Table 1, therefore, would be smaller. However, this is well within the bounds of the uncertainties associated with this analysis.

This analysis calculates from the available data in WASH 1400 an upper bound of the risk associated with a vital bus always being energized by an IPS. This is because it has been assumed that loss of this vital bus and the worst single failure will result in insufficient power to all ESF systems causing the ESF systems to fail to operate on demand, the core to melt, and radioactivity to be released from containment. This will not necessarily be true. The conditions for non-actuation of the automatic ESF Actuation System may or may not be limited to specific responses when vital buses fail. For example, the Hi-Hi train of the Consequence Limiting Control System (as noted in Appendix II of WASH 1400) (Ref. 5) is precluded from tripping on loss of power, but the Hi train does trip.

A lower bound on the increment in the risk associated with always energizing a vital bus from an IPS can be calculated by assuming that the loss of a vital bus is not the dominant contributor to accident sequences in the minor part of insufficient power to an ESF system per demand (the 10^{-7} part). The loss of a vital bus will probably contribute no less than 10 percent to the accident sequences in the minor part of insufficient power to

an ESF system per demand. This results in an increase in risk associated with a vital bus always being energized by an IPS of 10 percent of the value given in Table 1, or about 0.5 man rems per reactor year. This lower bound should encompass the uncertainties discussed above.

6. ALTERNATIVE POSSIBLE ACTIONS

There are three courses of action that may be taken by NRC. These actions are listed below in the order of ascending cost to the licensee.

1. No imposition of additional Technical Specifications or other requirements on the time a 120 Vac vital bus may be energized from an IPS.
2. Imposition of additional Technical Specifications on the time that a 120 Vac vital bus may be energized from an IPS.
3. Imposition of additional Technical Specifications that require that a vital bus must be energized by a UPS when the plant is in operational modes 1 to 4 (as defined in the Standard Technical Specification).

These alternative courses of action apply only to those vital buses which normally are energized from a UPS. This analysis did not consider the vital buses in certain plants which are energized solely by an IPS (off-site power). Some plants have vital buses energized solely by an IPS and all plants have some vital buses energized by UPS.

The proposed action detailed in this report is Alternative 2. The proposed time that a vital bus may be energized from an IPS was determined from the following value/impact summary.

7. VALUE/IMPACT STUDY

In determining the value/impact of the alternatives, the value of the actions is considered to be the reduction in the incremental risk associated with a vital bus that is energized by an IPS for a specified period of time. The calculated incremental risk, which is shown in Table 1, is the risk factor associated with a vital bus always being energized by an IPS, as opposed to it always being energized by a UPS. The maximum reduction in incremental risk would be provided by Alternative 3, i.e., requiring a vital bus to be energized by a UPS at all times.

The impact of the alternative actions is defined as the cost to the Licensee to implement the proposed action or an alternative. The costs include the direct cost of equipment needed and the indirect cost of its installation, but do not include the cost to NRC and the Licensee for the regulatory process of any review of the Licensee's implementation of either an alternative or the proposed action.

Table 2 lists the value and impact of the alternative actions. Alternative 1 (not limiting the time a vital bus is energized from an IPS) is the present situation.

The value/impact shown in Table 2 for Alternative 2 (limiting the time a vital bus is energized from an IPS) is based on limiting the time to 30 days/year (about 1/10th of a reactor-year) or 72 hours/year (about 1/100th of a reactor-year). The impact for the 30-day restriction is the cost of a few key spare parts of an inverter. Only a few key spare parts are needed, because the Licensee has sufficient time to get any additional parts needed to return the vital bus to a UPS from an outside source. The impact for the 72-hour restriction is the equivalent cost of an inverter. Parts equivalent to an inverter may be necessary because the Licensee may not have sufficient time to obtain from an outside source what is needed to return the vital bus to a UPS.

TABLE 2

Value/Impact of Alternative Actions

Alternative	Time a Vital Bus is Permitted to be on an IPS	Impact (Associated Costs)	Annualized Costs (20% Interest)	Value (Reduction in Risk Per Year-man-rem)	Value/Impact \$/man-rem
1	No restriction	0	0	0.0	-----
2	a) 30 days (1/10th reactor year)	\$1,000*	~ \$200	4.5	~ \$50
	b) 72 hrs (1/100 reactor year)	\$25,000**	~ \$5,000	4.9	~ \$1,000
3	0 hours	\$50,000***	~ \$10,000	5.0	~ \$2,000

* Estimated costs for a few key spare parts for an inverter.

** Direct cost of spare parts equivalent to an inverter.

*** Direct cost of an inverter and the indirect costs of its installation (assumed equal to 100% of direct cost).

The value of Alternative 2 is the reduction in risk of allowing a vital bus to be energized from an IPS for only 1/10th of a year (30 days) or for only 1/100th of a year (72 hours). These reductions provide per reactor-year 90 percent (4.5 man-rem) and 99 percent (4.95 man-rem) of the maximum reduction in risk associated with allowing a vital bus to be always energized from an IPS (5 man-rem).

Alternative 3 is to require the Licensee to always have the vital bus on a UPS. The impact to the Licensee is the cost of purchasing and installing a spare inverter for the vital buses to always be on a UPS. The value of this alternative is the maximum reduction in risk associated with a vital bus always being energized from an IPS (5 man-rem).

The impact of each of the alternatives shown in Table 2 does not include the cost of any downtime for the plant. It is assumed that the Licensee will take whatever steps are necessary to prevent downtime by having key spare parts on hand or by installing a spare inverter. This can be accomplished while the plant is operating.

The impact to the Licensee of each of the alternatives is the annual cost of the alternatives, based on the interest rate of money borrowed by the Licensee. This annual cost to the Licensee in the value/impact summary is discussed in Appendix A of draft Regulatory Guide 1.110 (Ref. 8). Because no annual operating cost or annual maintenance cost is associated with equipment needed for the alternatives, the annual cost of each alternative is the total cost of equipment needed times the capital recovery factor. The capital recovery factor is the levelized annual charge to the Licensee which takes into account the cost of borrowed money and the depreciation of assets. For a 20 percent interest cost on borrowed money, the capital recovery factor is 0.205 for a plant service life of 20 years. The annual cost of each alternative is also shown on Table 2.

The value/impact of each alternative in Table 2 is given in dollars/man-rem. This figure should be compared to the \$1,000 per man-rem figure given in NUREG 0800 (Ref. 9). An action costing up to \$1,000 to save a man-rem exposure risk is cost-beneficial to society. Conversely, an action costing more than \$1,000 to save a man-rem exposure risk is not cost-beneficial to society.

The costs involved (but not included in Table 2) in the regulatory process for the Licensee to propose Technical Specifications and for the NRC to review these Technical Specifications are as follows:

- (1) NRC costs for a licensing action (estimated on the order of \$6,000 per plant based on a minor Technical Specification change).
- (2) Cost to the Licensee to propose a Technical Specification change (1 man-week (Ref. 10)).

8. RECOMMENDATIONS

The calculations in this report show that a safety improvement can be accomplished by limiting the time a 120 Vac vital bus may be energized by an IPS. Based on the criterion of \$1,000/man-rem and the results of this evaluation, a time limit for a vital bus normally UPS-energized to be IPS-energized was derived. Therefore, the recommendation to the NRC is that the Licensees be requested to propose changes to their Technical Specifications to incorporate an annual 72-hour time limitation for energizing a vital bus from an IPS.

A generic letter including model Technical Specifications limiting the time a vital bus is on an IPS to 72 hours a year should be sent to the PWR Licensees. The model Technical Specifications are given in the Appendix. The PWR Licensees would be requested to propose the Technical Specifications for their vital buses that are normally energized by a UPS.

The cost to retrofit plants that do have a 120 Vac vital bus normally energized by an IPS was examined. It appeared that significant modifications and associated costs would be involved in excess of Alternative 3. The maximum benefit would be 5 man-rem. On this basis, it is not recommended that any action be taken.

9. ASSUMPTIONS

Because of the limited nature of the scope of work on this topic, the NRC stated that the following assumptions were to be made:

- (1) The probabilities and failure rate estimates in WASH 140C should be used.
- (2) The criterion for proposing any action should be the \$1,000 per man-rem from NUREG 0880 (Ref. 9).
- (3) Draft Regulatory Guide 1.110 (Ref. 8), a guide for cost-benefit calculations should be used with adjustments necessary for this issue.

10. STATUTORY CONSIDERATIONS

The authority for NRC to require Licensees to limit the time a vital bus is energized from an IPS is 10CFR, Part 50 Appendix A (Ref. 1). This Appendix, "General Design Criteria for Nuclear Power Plants," defines the minimum requirements for water-cooled nuclear power plants. The specific General Design Criteria (GDC) are GDC 17 (Electric Power Systems), GDC 23 (Protection System Failure Modes), and GDC 29 (Protection Against Anticipated Operational Occurrences). GDC 17 requires that the on-site electric distribution system shall have sufficient independence and redundancy to perform its safety function, assuming a single failure. GDC 23 requires that the protection system fail into a safe state upon loss of an electric power system. GDC 29 requires that protection control systems be designed to assure an extremely high probability of accomplishing their safety functions in the event of anticipated operational occurrences.

This proposed action is not a major action that might significantly affect the quality of the human environment, and thus does not require preparation of an environmental impact statement. The recommended Technical Specification revision would be a non-substantive and an insignificant license amendment from the standpoint of the environmental impacts of Parts 20, 30, 40, 50, 60, 70, 71, 73, 100, or 110 of Title 10 of the Code of Federal Regulations. This action will not increase the types or amounts of effluents from a plant, the potential for accidental releases, or the authorized power level of a plant. Therefore, based on 10 CFR, Part 51.5(d)(3), an environmental impact statement need not be prepared and a negative declaration may be issued to that effect.

NUMBERED REFERENCES

1. Code of Federal Regulations, Title 10, Part 50 (10CFR50).
2. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."
3. IEEE Standard 308-1974, "Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."
4. NRC letter, C. Michelson (Director, Office for Analysis and Evaluation of Operational Data) to H. Denton (Director, Nuclear Reactor Regulation), dated July 15, 1980.
5. Reactor Safety Study, WASH 1400, October 1975.
6. NUREG-0348, "Demographic Statistics Pertaining to Nuclear Power Reactor Sites," dated October 1979.
7. NUREG/CR-2800 Draft, "Guidelines for Nuclear Power Plant Safety Issue Prioritization Information Development," dated May 1982.
8. Regulatory Guide 1.110, Draft, "Cost-Benefit Analysis for Radwaste Systems for Light-Water Cooled Nuclear Power Reactors."
9. NUREG-0880 Draft Division Paper, "Safety Goals for Nuclear Power Plants, dated February 1982.
10. NRC Request for OMB Review on Technical Specifications for Class 1E Vital Instrument Buses dated July 13, 1981.

ADDITIONAL REFERENCES INCORPORATED IN THE ABOVE

Policy Issue SECY-81-513 from William Dircks to the Commissioners, dated August 25, 1981.

NRC letter, J. T. Beard to G. Lainas, dated July 24, 1980.

NRC letter, H. Denton to C. Michelson, dated September 29, 1980.

NRC letter, J. Roe to D. L. Asst. Directors, dated October 8, 1980.

NRC letter, G. Lainas to T. Novak, dated August 7, 1981.

NUREG-0103, Rev. 4, "Standard Technical Specifications for Babcock and Wilcox Pressurized Water Reactors."

Additional References, cont.

NUREG-0212, Rev. 2, "Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors."

NUREG-0452, Rev. 4, "Standard Technical Specifications for Westinghouse Pressurized Water Reactors."

IEEE Standard 279-1981, "Criteria for Protection Systems for Nuclear Power Generating Stations."

Statement of work, B and R Number 20-19-10-11-1, FIN/189A Number A-0250.

NRR Office Letter 16, Revision 1, H. Denton to all NRR employees.

NRR Office Letter 38, H. Denton to all NRR employees, dated April 21, 1982.

Code of Federal Regulations, Title 10, Part 170, Paragraph 170.22, "Schedule of Fees for Facility License Amendments."

APPENDIX

ELECTRICAL POWER SYSTEMS 3/4.8.3 ON-SITE POWER DISTRIBUTION OPERATING LIMITING CONDITION FOR OPERATION

3.8.3.1 The following electrical busses shall be energized in the specified manner with tie breakers open (both) between redundant buses within the unit (and between units at the same station):

- a. (120) volt ac Vital Bus # _____ energized from its associated inverter connected to dc Bus # _____*.
- b. (120) volt ac Vital Bus # _____ energized from its associated inverter connected to dc Bus # _____*.
- c. (120) volt ac Vital Bus # _____ energized from its associated inverter connected to dc Bus # _____*.
- d. (120) volt ac Vital Bus # _____ energized from its associated inverter connected to dc Bus 3 _____*.

APPLICABILITY: MODES 1, 1, 3 and 4.

ACTION

With One ac Vital Bus either not energized from its associated inverter, or with the inverter not connected to its associated dc Bus: (1) re-energize the ac Vital Bus within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours; and (2) re-energize the ac Vital Bus from its associated inverter connected to its associated dc Bus within 72 hours accumulative per year or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.8.3.1 The specified buses shall be determined energized in the required manner at least once per 7 days by verifying correct breaker alignment and indicated voltage on the buses.

*Two inverters may be disconnected from their dc Bus for up to 24 hours as necessary, for the purpose of performing an equalizing charge on their associated battery bank provided (1) their vital buses are energized, and (2) the vital buses associated with the other battery bank are energized from their associated inverters and connected to their associated dc Bus.