TECHNICAL EVALUATION REPORT

PALO VERDE NUCLEAR GENERATING STATION

STATION BLACKOUT EVALUATION

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1.0 BACKGROUND

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50 by adding a new section, 50.63, "Loss of All Alternating Current Power" (1). The objective of this requirement is to assure that all nuclear power plants are capable of withstanding a station blackout (SBO) and maintaining adequate reactor core cooling and appropriate containment integrity for a required duration. This requirement is based on information developed under the commission study of Unresolved Safety Issue A-44, "Station Blackout" (2-6).

The staff issued Regulatory Guide (RG) 1.155, "Station Blackout," to provide guidance for meeting the requirements of 10 CFR 50.63 (7). Concurrent with the development of this regulatory guide, the Nuclear Utility Management and Resource Council (NUMARC) developed a document entitled, "Guidelines and Technical Basis for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00 (8). This document provides detailed guidelines and procedures on how to assess each plant's capabilities to comply with the SBO rule. The NRC staff reviewed the guidelines and analysis methodology in NUMARC 87-00 and concluded that the NUMARC document provides an acceptable guidance for addressing the 10 CFR 50.63 requirements. The application of this method results in selecting a minimum acceptable SBO duration capability from two to sixteen hours depending on the plant's characteristics and vulnerabilities to the risk from station blackout. The plant's characteristics affecting the required coping capability are: the redundancy of the onsite emergency AC power sources, the reliability of onsite emergency power sources, the frequency of loss of offsite power (LOOP), and the probable time to restore offsite power.

In order to achieve a consistent systematic response from licensees to the SBO rule and to expedite the staff review process, NUMARC developed two generic response documents. These documents were reviewed and endorsed (9) by the NRC staff for the purposes of plant specific submittals. The documents are titled:

1. "Generic Response to Station Blackout Rule for Plants Using Alternate AC Power," and

2. "Generic Response to Station Blackout Rule for Plants Using AC Independent Station Blackout Response Power."

A plant-specific submittal, using one of the above generic formats, provides only a summary of results of the analysis of the plant's station blackout coping capability. Licensees are expected to ensure that the baseline assumptions used in NUMARC 87-00 are applicable to their plants and to verify the accuracy of the stated results. Compliance with the SBO rule requirements is verified by review and evaluation of the licensee's submittal and audit review of the supporting documents as necessary. Follow up NRC inspections assure that the licensee has implemented the necessary changes as required to meet the SBO rule.

In 1989, a joint NRC/SAIC team headed by an NRC staff member performed audit reviews of the methodology and documentation that support the licensees' submittals for several plants. These audits revealed several deficiencies which were not apparent from the review of the licensees' submittals using the agreed upon generic response format. These deficiencies raised a generic question regarding the degree of licensees' conformance to the requirements of the SBO rule. To resolve this question, on January 4, 1990, NUMARC issued additional guidance as NUMARC 87-00 Supplemental Questions/Answers (10) addressing the NRC's concerns regarding the deficiencies. NUMARC requested that the licensees send their supplemental responses to the NRC addressing these concerns by March 30, 1990.

2.0 REVIEW PROCESS

The review of the licensee's submittal is focused on the following areas consistent with the positions of RG 1.155:

A. Minimum acceptable SBO duration (Section 3.1),

B. SBO coping capability (Section 3.2),

C. Procedures and training for SBO (Section 3.4),

D. Proposed modifications (Section 3.3), and

E. Quality assurance and technical specifications for SBO equipment (Section 3.5).

For the determination of the proposed minimum acceptable SBO duration, the following factors in the licensee's submittal are reviewed: a) offsite power design characteristics, b) emergency AC power system configuration, c) determination of the emergency diesel generator (EDG) reliability consistent with NSAC-108 criteria (11), and d) determination of the accepted EDG target reliability. Once these factors are known, Table 3-8 of NUMARC 87-00 or Table 2 of RG 1.155 provides a matrix for determining the required coping duration.

For the SBO coping capability, the licensee's submittal is reviewed to assess the availability, adequacy and capability of the plant systems and components needed to achieve and maintain a safe shutdown condition and recover from an SBO of acceptable duration which is determined above. The review process follows the guidelines given in RG 1.155, Section 3.2, to assure:

a. availability of sufficient condensate inventory for decay-heat removal,

b. adequacy of the class-1E battery capacity to support safe shutdown,

c. availability of adequate compressed air for air-operated valves necessary for safe shutdown,

d. adequacy of the ventilation systems in the vital and/or dominant areas that include equipment necessary for safe shutdown of the plant,

e. ability to provide appropriate containment integrity, and

f. ability of the plant to maintain adequate reactor coolant system inventory to ensure core cooling for the required coping duration.

The licensee's submittal is reviewed to verify that required procedures (i.e., revised existing and new) for coping with SBO are identified and that appropriate operator training will be provided.

The licensee's submittal for any proposed modifications to emergency AC sources, battery capacity, condensate capacity, compressed-air capacity, ventilation systems, containment isolation valves, and primary coolant make-up capability is reviewed. Technical specifications and quality assurance set forth by the licensee to ensure high reliability of the equipment, specifically added or assigned to meet the requirements of the SBO rule, are assessed for their adequacy.

The licensee's proposed use of an alternate AC power source is reviewed to determine whether it meets the criteria and guidelines of Section 3.3.5 of RG 1.155 and Appendix B of NUMARC 87-00.

This SBO evaluation is based upon the review of the licensee's submittals dated April 14, 1989 (12), March 26, 1990 (13), December 11, 1990 (15), and August 31, 1991 (18); a

telephone conversation with the licensee on June 11, 1991, as a result of which the licensee provided a copy of an internal correspondence which addressed the questions raised (16); information on its heat-up calculations (17); a package of information provided (19) by the licensee during its presentation to the NRC on July 15, 1991, describing its addition of an AAC power source; and the information available in the plant Updated Final Safety Analysis Report (UFSAR) (14) and the Combustion Engineering Standard Safety Analysis Report (CESSAR) (20). An audit may be warranted as an additional confirmatory action. This determination would be made and the audit would be scheduled and performed by the NRC staff at some later date.

3.0 EVALUATION

The licensee, Arizona Public Service Company (APS), initially proposed that the Palo Verde Nuclear Generating Station (PVNGS) would be a 4-hour coping category plant under SBO conditions using cross-connected class-1E batteries with extended capacity for SBO loads (12, 13, and 15). APS re-evaluated the PVNGS design commitments and now plans to meet the criteria to be designated as an alternate AC (AAC) power source plant (16 and 18). This evaluation is based on the licensee's most recent submittal (18). Although the licensee stated that its most recent submittal supersedes all other submittals, the previous submittals are used nevertheless for supplemental information. Some statements and commitments made by the licensee prior to the most recent submittal are still considered to be valid in this evaluation. The licensee should confirm that this information is in fact still valid.

3.1 Proposed Station Blackout Duration

Licensee's Submittal

PVNGS is an AAC plant with a required coping duration of four hours. Although it is not clearly stated by the licensee, no design modifications are required to attain this coping duration. The licensee has provided an AC independent coping analysis for the one-hour period required to bring the AAC power source on line (18).

The plant factors used to estimate the proposed SBO duration are:

1. **Offsite Power Design Characteristics**

   The plant AC power design characteristic group is "P1" based on:

   a. Independence of the plant offsite power system characteristics of "I1/2,"

b. Expected frequency of grid-related LOOPs of less than one per 20 years,

c. Estimated frequency of LOOPs due to extremely severe weather (ESW) which places the plant in ESW Group "2" if the NUMARC 87-00 data is used, or in ESW Group "3" if site-specific data and Table 8 of RG 1.155 is used, and

d. Estimated frequency of LOOPs due to severe weather (SW) which places the plant in SW Group "1."

2. **Emergency AC (EAC) Power Configuration Group**

The EAC power configuration of the plant is "C." Each PVNGS unit is equipped with two dedicated emergency diesel generators not credited as alternate AC (AAC) power sources, one of which is necessary to operate safe-shutdown equipment following a loss of offsite power.

3. **Target Emergency Diesel Generator (EDG) Reliability**

The licensee has selected a target EDG reliability of 0.95. The selection of this target reliability is based on having an average EDG reliability greater than 0.90, 0.94, and 0.95 for the last 20, 50, and 100 demands, respectively, consistent with NUMARC 87-00, Section 3.2.4.

The licensee stated (13) that it presently has an EDG reliability program which contains elements consistent with RG 1.155. The licensee added that it recognizes that the program may be modified depending on the resolution of Generic Issue B-56 (EDG Reliability). The EDG reliability program was not addressed in the most recent submittal (18).

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the independence of the offsite power system grouping, the estimated frequency of LOOPs due to ESW and SW conditions, the expected frequency of grid-related LOOPs, the classification of EAC, and the selection of EDG target reliability. Using Table 3-3 of NUMARC 87-00, the expected frequency of LOOPs at PVNGS due to SW condition is group "1." Using Table 3-2 of NUMARC 87-00, the expected frequency of LOOPs due to ESW conditions place the PVNGS site in ESW group "2." However, the licensee indicated (18) that, based on site-specific data and Table 8 of RG 1.155, the site is in ESW group "3." This change in ESW grouping does not change the AC power design characteristic group, and, therefore, it does not affect the 4-hour coping duration.

The licensee stated that the independence of the plant offsite power system grouping is "I1/2." According to the information available in the plant UFSAR:

1. All offsite power sources are connected to the plant through one switchyard;

2. Each unit has two emergency busses, each of which is powered from a different offsite power source;

3. During normal operation, power is provided to the safety busses from the two start-up transformers (SUTs) associated with the unit, or from one of the SUTs associated with the other two units;

4. Upon loss of power from either source, there is a transfer to the remaining source.

Based on these and the criteria stated in Table 5 of RG 1.155, we conclude that the plant independence of offsite power system group is "I2."

The licensee correctly classified the EAC configuration of PVNGS as "C." At Palo Verde, there are two 5500-kW diesel generators per unit, one of which is necessary to safely shut down the plant.

The licensee selected an EDC target reliability of 0.95 based on the EDG reliability data for the last 20, 50, and 100 demands. We did not receive the values for the EDG reliability statistics. The licensee needs to have the values for the EDG reliability statistics for the last 20, 50, and 100 demands in its SBO submittal supporting documentation. The information in NSAC-108 (11) gives the EDG reliability data at U.S. nuclear reactors for calendar years 1983 to 1985. Since none of the three Palo Verde units was in commercial operation during this period, we do not have any information on the EDG reliability at PVNGS. However, the licensee can choose any EDG target reliability consistent with the minimum required SBO coping duration, provided that it is maintained. The licensee has provided this commitment in its submittal dated March 26, 1990 (13).

With regard to the expected frequency of grid-related LOOPs at the site, we can not confirm the stated results. The available information in NUREG/CR-3992 (3), which gives a compendium of information on the loss of offsite power at nuclear power plants in the U.S., only covers these incidents through the calendar year 1984. Palo Verde Units 1, 2, and 3 did not enter commercial operation until 1986, 1986, and 1988, respectively. In the absence of any contradictory information, we agree with the licensee's statement.

Based on the above, the offsite power design characteristic for the Palo Verde site is "P1" with a minimum required coping duration of four hours.

3.2 Alternate AC (AAC) Power Source

Licensee's Submittal

The licensee stated (18) that it is going to add two 4.2-MW gas turbine generators (GTGs) to be used as an AAC power source, and will be available within one hour of the onset of an SBO event. The licensee added that each of the two GTGs meets the criteria specified in Appendix B to NUMARC 87-00 and provided a statement on each criterion. Each GTG power source will have sufficient capacity and capability to operate those systems necessary for coping with an SBO for the required duration of four hours to bring the plant to and maintain the plant in a safe-shutdown condition. In the information provided by the licensee during the meeting with the NRC on July 15, 1991, the licensee indicated (19) that the AAC power source will be connected to Train A of each unit through the 13.8-kV level, although this was not stated in the licensee's official submittal (18). A review of UFSAR Figure 8.3-1 indicates that the AAC power source will also have the ability to be connected to Train B at the 4.16-kV level. The necessary modification will be completed in November 1994, during Unit 2's fifth refueling outage.

Review of Licensee's Submittal

We reviewed the licensee's proposed AAC power source, two GTGs, to verify that they meet all of the required criteria in Appendix B to NUMARC 87-00. In its August 31, 1991 submittal (18), the licensee provided a list of how the GTGs meet the Appendix B criteria. For Criterion B.10, which requires the AAC power source to be tested at intervals not longer than three months, the licensee stated that this requirement will be included in the applicable plant procedures. In the same submittal, the licensee stated that the AAC power sources shall be demonstrated operable by test once during each refueling outage, which is about every 18 months. We consider this statement to mean that the licensee intends to load the emergency busses onto the AAC power source once

every refueling outage to demonstrate its capacity and connectability and that the licensee will start the AAC power source at least once every three months, without loading the emergency busses onto it, to demonstrate its operability. The licensee needs to clarify its intent with respect to the three-month testing requirement. We agree with the licensee that the proposed AAC power source meets the requirements of Appendix B to NUMARC 87-00, pending clarification of the three-month testing requirement.

Our review indicates that each 4.2-MW GTG has sufficient capacity to power the necessary loads. Since the AAC power source will be connectable to one of the two redundant trains of safe-shutdown equipment, the GTGs will have the capability to power the necessary equipment.

3.3 Station Blackout Coping Capability

The plant coping capability with an SBO event for the required duration of four hours is assessed with the following results:

1. **Condensate Inventory for Decay-Heat Removal**

Licensee's Submittal

The licensee stated (18) that 85,000 gallons of water are required for decay-heat removal during the four-hour coping period. The minimum permissible condensate storage tank (CST) level per technical specifications provides 300,000 gallons of water.

In response to questions asked during the telephone conversation on June 11, 1991, concerning the amount of condensate necessary for cooldown, the licensee provided (16) the following list of the elements which contribute to the total amount of water necessary to achieve cold shutdown over a eight-hour time period:

Decay-Heat Removal (for 8 hours)	197,000 gallons
Sensible-Heat Removal	39,000 gallons
Steam Generator Inventory Recovery	29,000 gallons
Aux. Cooling Requirement	2,300 gallons
Total	258,300 gallons

The licensee stated (16) that these values were calculated to support the adequacy of the condensate supply, based on the maximum expected Branch Technical Position RSB 5-1 scenario. The licensee concluded that the technical specifications minimum level (300,000 gallons) exceeds the amount of water necessary to achieve cold shutdown.

Review of Licensee's Submittal

Using the expression provided in NUMARC 87-00, we have estimated that the water required for removing decay heat during the four-hour SBO would be 85,700 gallons. This estimate is based on 102% of a maximum licensed core thermal rating of 3800 MWt. If the value for the amount of condensate necessary for 8 hours of decay-heat removal (197,000 gallons) is replaced with the four-hour value (85,700 gallons), the result is a conservative estimate of the amount of condensate needed to cool down in four hours. For four hours, the total amount of condensate needed is estimated to be 156,000 gallons. Since the minimum permissible CST level corresponds to 300,000 gallons of condensate, Palo Verde has sufficient condensate to cope with a four-hour SBO event.

2. **Class-1E Battery Capacity**

Licensee's Submittal

The licensee stated (18) that the current design basis for the class-1E batteries requires sufficient capacity to support the SBO loads for two hours. The licensee

added that calculation 13-EC-PK-202 has been preformed which verifies the design basis requirement. The licensee concluded that the batteries will be able to meet the one-hour requirement to support the SBO loads until the AAC power source is ready to carry the loads.

In its submittal (16) dated June 14, 1991, which contains written responses to the questions raised during the telephone conversation on June 11, 1991, the licensee stated that the C and D channel batteries (1150 Ampere-hours) will be replaced with batteries of equal capacity to the A and B channel batteries (1800 Ampere-hours). In its most recent submittal (18), the licensee did not indicate if the battery modification will still be made.

Review of Licensee's Submittal

According to the plant UFSAR (Section 8.3.2.1.2.1), the class-1E batteries have sufficient capacity to independently supply the required loads for two hours. The modification to change the C and D channel batteries to larger ones does not affect the licensee's ability to cope with an SBO event. Since the AAC power source will be available within one hour of the onset of an SBO event and will power one division of battery chargers, PVNGS has sufficient battery capacity.

3. **Compressed Air**

Licensee's Submittal

The licensee stated (18) that the air-operated valves relied upon to cope with an SBO event of one-hour duration can either be operated manually or have sufficient back-up sources independent of both the offsite and the blacked-out unit's onsite AC power systems. The only valves that require pneumatic energy to ensure proper operation during an SBO event are the atmospheric dump valves (ADVs) and the

reactor coolant pump (RCP) seal bleed-off valves. The licensee stated (18) that the ADVs have a 13.3-hour (actual) dedicated supply of compressed nitrogen gas, given a loss of power to the unit instrument air compressors, and the RCP seal bleed-off valves "will have" nitrogen gas supply as a back-up to the compressed-air system to maintain valve closure until the RCS charging system becomes operational when the AAC power source is available.

Review of Licensee's Submittal

Our review of UFSAR Section 10.3.2.2.4 indicates that the ADVs have nitrogen accumulators sized for four hours at hot standby plus 6.5 hours of operation to reach cold shutdown under natural circulation conditions. Therefore, the ADVs have sufficient back-up nitrogen supplies to cope with an SBO.

The licensee's statement indicates that the RCP seal bleed-off valves "will have" a back-up nitrogen supply. We do not know if the licensee means that a modification will be made to the system or whether the current configuration provides the back-up supply. Our review of the RCP seal bleed-off valves (CESSAR Figure 9.3-1) indicates that these valves fail closed upon loss of air in a short period of time, depending upon the pressure in the compressed-air system. The licensee proposed (15) modifications to improve the reliability of control air power to these valves. The licensee needs to clarify its plans with regard to providing back-up control-air supply to the RCP seal bleed-off valves.

4. **Effects of Loss of Ventilation**

Licensee's Submittal

The licensee stated (18) that its loss of ventilation analysis for the turbine-driven AFW pump room, DC equipment room, switchgear room, battery room, charging

pump room, control room, and the containment building shows that equipment operability limits are not exceeded in the one-hour coping period prior to the initiation of the AAC power source. The licensee used a non-NUMARC method, a time-dependent heat-up analysis, for its calculation of the temperature rise in the areas of concern. The licensee added that it checked its results against that using the NUMARC methodology and found that both yielded identical results under steady-state conditions.

The licensee provided (16 and 17) the following post-SBO temperatures:

Area of Concern		Temperature (°F)	
		Initial	Final
Switchgear Room	- 1 hour	85 (104)†	86.25 (105.25)†
	- 4 hours	85	87.04
DC Equip. Room	- 1 hour	85 (104)	100.6 (119.6)
	- 4 hours	85	93.98
Control Room	- 1 hour	75.5 (94.5)	89.39 (108.39)
AFW Room	- 1 hour	104	138
	- 4 hours	104	149.3
Charging Pump Rm		90	103.8‡

† The temperatures in parentheses are the maximum initial and final temperatures
‡ The pump starts when the AAC power source is established (within one hour) and has ventilation available

In its submittal dated December 11, 1990 (15), the licensee stated that the calculated temperature of ~150°F (149.3°F) exceeds the operability limit (140°F) of the Z to I (impedance to current) position transmitters for two of the ADV trains located in the turbine-driven AFW pump room. The licensee added that these position transmitters would be upgraded or moved to a location where their operability limit would not be exceeded. Aside from this, the licensee concluded (16) that no equipment operability limit would be violated during a four-hour SBO event without HVAC.

Review of Licensee's Submittal

Upon review of the information provided by the licensee, we concur with the licensee's conclusions regarding equipment operability in the charging pump room and the containment.

In the above table, the four-hour final temperature for the DC equipment room (93.98°F) is less than the one-hour temperature (100.6°F). Our review of the licensee's heat-up calculations (17) indicates that the four-hour temperature is an error and should be 104.7°F.

DC Equipment and Switchgear Rooms

We consider the DC equipment and switchgear rooms to have HVAC within one hour, when the AAC power source is established, and therefore we concur with the licensee's one-hour assessment. In its four-hour assessment of the temperatures for these rooms, the licensee used a non-conservative initial temperature of 85°F. If HVAC is not available to the DC equipment and switchgear rooms within one hour and the licensee is basing its equipment operability on its four-hour assessment, then the licensee needs to have an administrative control on the temperatures for these rooms. This control must ensure that, under normal operating conditions, the temperature in these rooms does not exceed 85°F at any time.

Control Room

Based on the information provided by the licensee, we found one non-conservative assumption. In its control-room heat-up calculations, it appears that the licensee used a heat-transfer coefficient for air to concrete of 2.53 Btu/hr·ft^{2}·°F. In the heat-up calculations for the DC equipment room and the switchgear room, the licensee used a more conservative value of 1.30 Btu/hr·ft^{2}·°F. On the other hand, the licensee assumed a conservative control-room heat load of 179 kW, which is considerably larger than that which other licensees have assumed by a factor of two

or three. The load in the control room during the first hour before the AAC power source is established is limited by the energy produced by the DC loads. Our review of the plant UFSAR indicates that, at their maximum loading (assuming every load is in the control room) the batteries would support 120 kW. Because of the use of such a large heat load (179 kW), we do not consider the use of the non-conservative heat-transfer coefficient to be of concern. Therefore, we agree with the licensee's conclusion that the control-room temperature will not exceed 120°F during the first hour. However, the licensee needs to open the cabinet doors in 30 minutes if HVAC is not available.

AFW Pump Room

Our review indicates that if the AAC power source powers the ventilation system for the turbine-driven AFW pump room, then the equipment operability is assured. However, should no HVAC be available for this room, then the licensee needs to either move or upgrade the Z to I position transmitters for the ADVs located in this room.

5. **Containment Isolation**

Licensee's Submittal

The licensee stated that the plant list containment isolation valves (CIVs) has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under SBO conditions can be positioned with indication independent of the class-1E power supplies. The licensee added that no modifications or associated procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under SBO conditions at Palo Verde for one hour.

Review of Licensee's Submittal

Upon review of the list of containment isolation valves (UFSAR Table 6.2.4-2), we did not find any valves which do not meet the exclusion criteria outlined in RG 1.155. Therefore, we concur with the licensee that adequate containment integrity can be provided under SBO conditions, should it become necessary.

6. Reactor Coolant Inventory

Licensee's Submittal

The licensee stated (18) that the ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for four hours. The licensee added that the expected rates of reactor coolant inventory loss under SBO conditions do not result in core uncovery. The licensee added that it used a plant-specific analysis for its assessment of the adequacy of reactor coolant inventory.

Review of Licensee's Submittal

Reactor coolant make-up is necessary to replenish the RCS inventory losses due to the reactor coolant pump seal leakage (25 gpm per pump per NUMARC 87-00 guideline), and the Technical Specifications maximum allowable leakage (estimated to be 12 gpm). In the one hour before the AAC power source is available to the charging pumps, the RCS will lose 6720 gallons of water due to the 112-gpm postulated leak rate.

Each Palo Verde unit has three 44-gpm charging pumps, one dedicated to each of the two ESF trains, and the third pump capable of being powered from either ESF train. Therefore, when the AAC power source becomes available, at most two charging pumps will be powered, providing 88 gpm of primary system make-up. For

the final three hours of the SBO event, using two charging pumps, the net leak rate will be 24 gpm, and the primary system will lose an additional 4320 gallons of water. The total primary system losses will be 11,040 gallons, which is approximately 1500 ft^3. Under normal full-power conditions, the pressurizer contains 900 ft^3 of water. Each of the two steam generators (SGs) contains 2339 ft^3 of primary coolant. At the end of the SBO event, the pressurizer would be empty and each SG would lose 300 ft^3, leaving more than 2000 ft^3 of primary water per SG. If only one charging pump is used, the primary system will lose another 1060 ft^3, which is small compared to the total RCS inventory (13,253 ft^3) at the beginning of the event. Therefore we concur with the licensee that sufficient RCS inventory exists to keep the core covered, and natural circulation, through reflux boiling, will keep the core cooled.

NOTE:

The 25-gpm reactor coolant pump seal leak rate was agreed to between NUMARC and the NRC staff pending resolution of Generic Issue (GI) 23. If the final resolution of GI-23 defines higher recirculation pump seal leak rates than assumed for the RCS inventory evaluation, the licensee needs to be aware of the potential impact of this resolution on its analyses and actions addressing conformance to the SBO rule.

3.4 Proposed Procedures and Training

Licensee's Submittal

The licensee stated that the following plant procedures have been reviewed per guidelines in NUMARC 87-00, Section 4:

1. Station blackout response guidelines,
2. AC power restoration, and
3. Severe weather.

The licensee stated that these procedures have been reviewed and the changes necessary to meet NUMARC 87-00 guidelines will be implemented.

Review of Licensee's Submittal

We neither received nor reviewed the affected SBO procedures. These procedures are plant-specific actions concerning the required activities to cope with an SBO. It is the licensee's responsibility to revise and implement these procedures, as needed, to mitigate an SBO event and to assure that these procedures are complete and correct, and that the associated training needs are carried out accordingly.

3.5 Proposed Modifications

Licensee's Submittal

In addition to the modifications to improve the reliability of the control-air supply for the RCP seal bleed-off valves and possibly moving or upgrading the Z to I position transmitters for two trains of ADVs, the licensee is planning on making the following modifications:

1. In order to switch from a four-hour coping plant to a four-hour AAC plant, the licensee is going to install two 4.2-MW GTGs and the necessary connections to each of the three units;

2. During the first hour after an SBO event, communication is provided by sound-power phones and the EPABX Telephone System which has sufficient battery capacity to power the system for eight hours. Radio communications will be provided by a design modification to the control room radio consoles which adds a battery back-up power source.

Review of Licensee's Submittal

In addition to the above modifications, we did not find the need for the licensee to make any additional modifications.

3.6 Quality Assurance and Technical Specifications

The licensee stated (18) that the non-safety-related equipment added to cope with the SBO condition will meet the requirements of Appendices A and B to RG 1.155.

4.0 CONCLUSIONS

Based on our review of the licensee's submittals and the information available in the UFSAR for Palo Verde Nuclear Generating Station, we find that the submittal conforms with the requirements of the SBO rule by following the guidance of RG 1.155 with the following exceptions:

1. **AAC Power Source**

   The licensee needs to clarify its statement regarding how it meets Criterion B.10 of Appendix B to NUMARC 87-00, which requires the AAC power source to be tested at intervals not longer than three months (See Section 3.2, page 10-11).

2. **Compressed Air**

   The licensee stated that the RCP seal bleed off valves "will have" a back-up nitrogen supply. We do not know if the licensee means that a modification will be made to the system or whether the current configuration provides the back-up supply. The licensee needs to clarify its statement on the back-up supplies of nitrogen gas for the RCP seal bleed-off valves.

3. **Effects of Loss of Ventilation**

   DC Equipment and Switchgear Rooms

   We consider the DC equipment and switchgear rooms to have HVAC within one hour, when the AAC power source is established, and therefore we concur with the licensee's one-hour assessment. For its four-hour assessment, the licensee assumed a non-conservative initial temperature of 85°F. If HVAC is not available to these rooms within one hour and the licensee intends to use its four-hour assessment as its basis for equipment operability, then it needs to have an administrative control

on the temperatures for these rooms. This control must ensure that, under normal operating conditions, the temperature in these rooms does not exceed 85°F at any time.

AFW Pump Room

Our review indicates that if the AAC power source powers the ventilation system for the turbine-driven AFW pump room, then the equipment operability is assured. However, should no HVAC be available for this room, then the licensee needs to either move or upgrade the Z to I position transmitters for the ADVs located in this room.

5.0 REFERENCES

1. The Office of Federal Register, "Code of Federal Regulations Title 10 Part 50.63," 10 CFR 50.63, January 1, 1989.

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