ENCLOSURE 2

TECHNICAL EVALUATION REPORT

SAN ONOFRE NUCLEAR GENERATING STATION UNIT 1

STATION BLACKOUT EVALUATION

Science Applications International Corporation

An Employee-Owned Company

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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 by the NRC staff (9) 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 licensee submittals using the agreed upon generic response format. These deficiencies raised a generic question regarding the degree of the 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 Regulatory Guide 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, appropriate containment integrity 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 on a review of the licensee's submittals dated April 17, 1989 (12) and May 1, 1990 (13), a telephone conversation between NRC/SAIC and the licensee on June 22, 1990, a follow-up letter from the licensee dated August 6, 1990 (14) and the information available in the

plant Updated Final Safety Analysis Report (UFSAR) (15); it does not include a concurrent site audit review of the supporting documentation. Such 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

3.1 Proposed Station Blackout Duration

Licensee's Submittal

The licensee, the Southern California Edison Company, calculated (12 and 13) a minimum acceptable SBO duration of four hours for the San Onofre Nuclear Generating Station Unit 1 (SONGS 1). The licensee stated that no modifications are necessary to attain this proposed coping duration.

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

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 "1," 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." SONGS 1 is equipped with two emergency diesel generators which are normally available to the unit safe shutdown equipment. One emergency AC

power supply is sufficient to operate safe shutdown equipment following a loss of offsite power.

3. Target Emergency Diesel Generator (EDG) Reliability

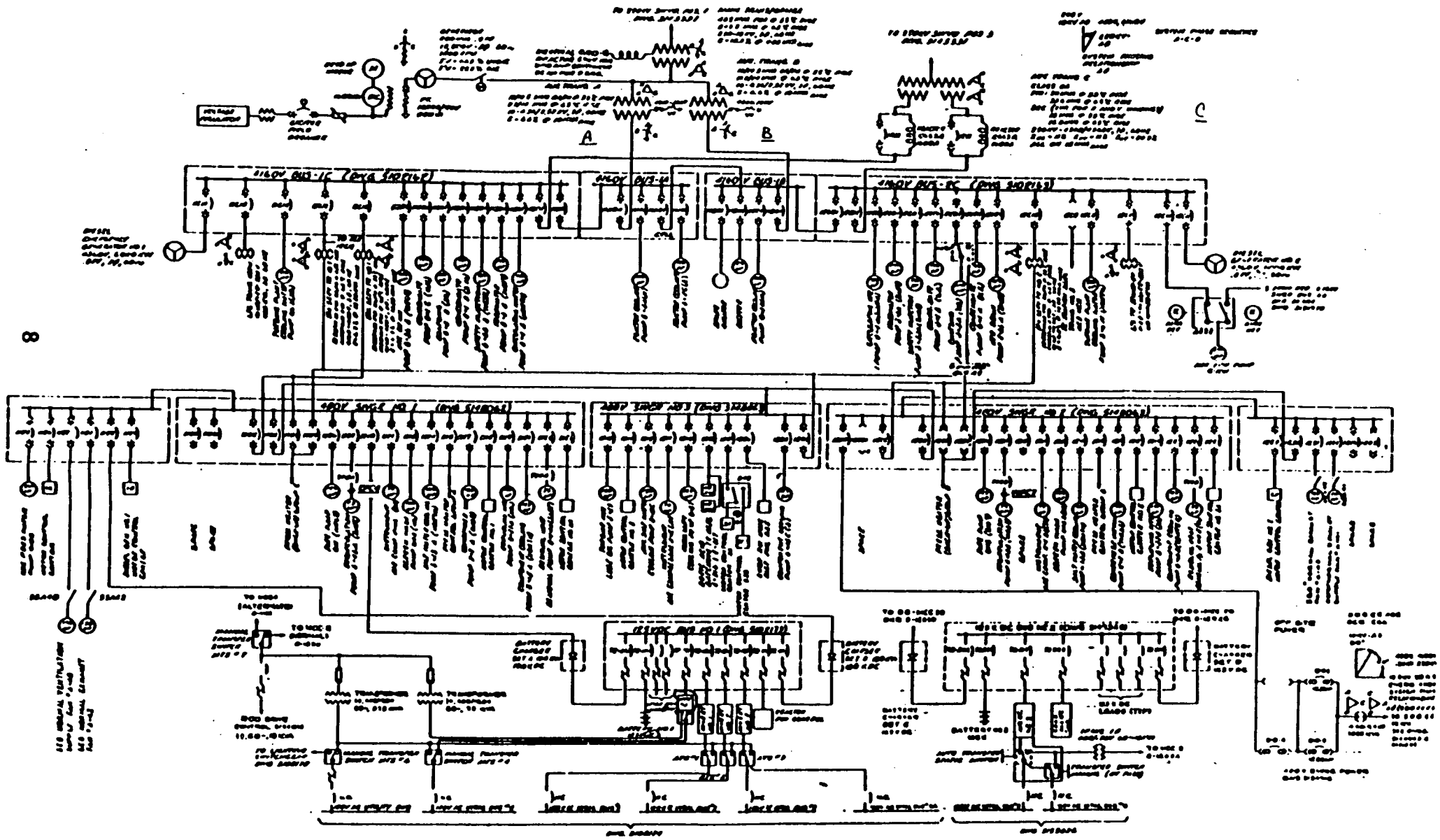
The licensee has selected a target EDG reliability of 0.95 based on having a nuclear unit average EDG reliability of greater than 0.95 for the last 100 demands.

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the independence of offsite power system grouping, the estimated frequency of LOOPs caused by grid-related failures, the estimated frequency of LOOPs caused by severe weather (SW) and extremely severe weather (ESW) conditions, the classification of EAC, and the selection of EDG target reliability.

The licensee's estimation of LOOP frequency caused by ESW and SW conditions are consistent with the guidance provided in NUMARC 87-00, Tables 3-2 and 3-3.

San Onofre site has two electrically connected switchyards, one owned by Southern California Edison (SCE) and one owned by San Diego Gas and Electric. The SCE switchyard is used for SONGS 1 outgoing (generated) power and incoming power. As shown in Figure 1 (15), the unit's auxiliary transformers A and B take power directly from the main generator's output and supply 4160 V buses 1A and 1B. Safety buses 1C and 2C are normally powered from the buses 1A and 1B. Upon failure of the main generator, the 4160 V buses (1A, 1B, 1C and 2C) are isolated from their respective auxiliary transformers and the generator is isolated from the grid. When the generator's voltage drops to 40% of nominal, a 30-second delay period is initiated. After the delay period, the main generator motor-operated disconnect starts to open. When the disconnect is fully open, 4160 V buses are re-energized from auxiliary


A
B
C

transformers A and B, which are the preferred source of back-up offsite power. According to the unit UFSAR, this cycle takes approximately two minutes. If the preferred source of power is not available, the safety buses 1C and 2C can be manually energized from auxiliary transformer C. Therefore, we agree with the licensee's conclusion that SONGS 1 is in offsite power group "I2."

Establishment of the proper Emergency AC (EAC) Configuration Group is based on the number of available EAC sources and the number of EAC sources required to operate safe shutdown equipment following a LOOP. SONGS 1 has two dedicated EAC sources, one is required after a LOOP. We agree with the licensees assessment which places the plant in EAC Group "C."

The final characteristic needed to establish the required coping duration is the target EDG reliability. The licensee stated (10) that the assignment of the EDG target reliability of 0.95 is based on having an average EDG reliability of greater than 0.95 for the last 100 demands. Although this is an acceptable criterion for choosing an EDG target reliability, the guidance in RG 1.155 requires that the EDG reliability statistics for the last 20 and 50 demands also be calculated. Without this information it is difficult to judge how well the EDGs have performed in the past and if there should be any concern. We are unable, however, to verify the demonstrated start and load-run reliability of the plant EDGs. This information is only available onsite as part of the submittal's supporting documents. The available information in the NSAC-108, which gives the EDG reliability data at U.S. nuclear reactors for calendar years 1983 to 1985, indicates that the EDGs at SONGS 1 experience an average of 27 valid demands per diesel per calendar year and have reliability levels of higher than 0.95. Using this data, it appears that the EDG target reliability (0.95) selected by the licensee (10) is appropriate. Nevertheless, the licensee needs to have an analysis showing the EDG reliability statistics for the last 20, 50, and 100 demands in its SBO submittal supporting documents.

In response to the requirement for an EDG reliability program the licensee stated (13) that a reliability program consistent with the clarified NUMARC 87-00, Appendix D, will be developed to ensure high EDG reliability. The licensee is also committed to maintain the targeted EDG reliability of 0.95 (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., covers only the events prior to the calendar year 1984. No grid-related LOOPS for SONGS 1 were reported. During the telephone conversation on June 22, 1990, the licensee stated that SONGS 1 has not had any grid-related LOOPs in the last 20 years. In the absence of any contradicting information, we agree with the licensee's statement.

Based on the above, the offsite power design characteristic of SONGS 1 is "P1" with a minimum required SBO coping duration of four hours.

3.2 Alternate AC (AAC) Power Source

Licensee's Submittal

The AAC power source is a dedicated safe-shutdown (DSD) system diesel generator that was installed in order to meet 10 CFR 50 Appendix R (fire protection) requirements. The licensee stated that the AAC power source is available within one hour of the onset of an SBO event and that it has sufficient capacity and capability to operate systems necessary for coping with an SBO with a duration of four hours. Additionally, the licensee stated that no modifications to the AAC source are needed to meet the requirements of NUMARC 87-00.

The licensee stated that major components of the AAC power source includes: a 4160 V diesel generator, an independent 4160 V and 480 V distribution system, an independent power supply for an auxiliary

feedwater pump, DSD panel, and necessary support equipment to perform functions required for safe shutdown, see Figure 2 (10).

Review of Licensee's Submittal

The AAC source is the non-class 1E DSD diesel located in a dedicated room to the west of the turbine building. The DSD system is not connected to the plant's safe shutdown buses; it supplies alternate power to selected equipment necessary to safely maintain the plant in hot standby. Since it is both electrically and physically separate from the class 1E electrical systems, and installed to meet the 10 CFR 50 Appendix R criteria, it meets criteria B.1 through B.7 of NUMARC 87-00, Appendix B.

During the telephone conversation on June 22, 1990, the licensee stated that the DSD diesel has a dedicated air-start system, fuel supply and storage system, and an eight hour battery. The engine is cooled by a radiator which needs no support from any plant systems. Based on this information, the DSD diesel should meet criteria B.8 of NUMARC 87-00, Appendix B.

In response to questions asked during the telephone conversation of June 22, 1990, the licensee submitted a list of loads connected to the DSD diesel (14). The loads, including a charging pump, an auxiliary feedwater pump, pressurizer heaters, lighting, diesel battery charger and assorted auxiliary loads, require a total of 1,057 kW, which is considerably less that the DSD capacity of 2,000 kW. Therefore, we agree that the DSD has adequate capacity to power all connected loads and meets criteria B.9 of NUMARC 87-00.

The licensee stated that the DSD diesel surveillance requirement is controlled by Technical Specification 4.15.8, which includes a requirement for quarterly demand testing. The licensee has committed to develop a reliability program for the DSD diesel (13). Although this surveillance would enhance the reliability of the DSD diesel, the

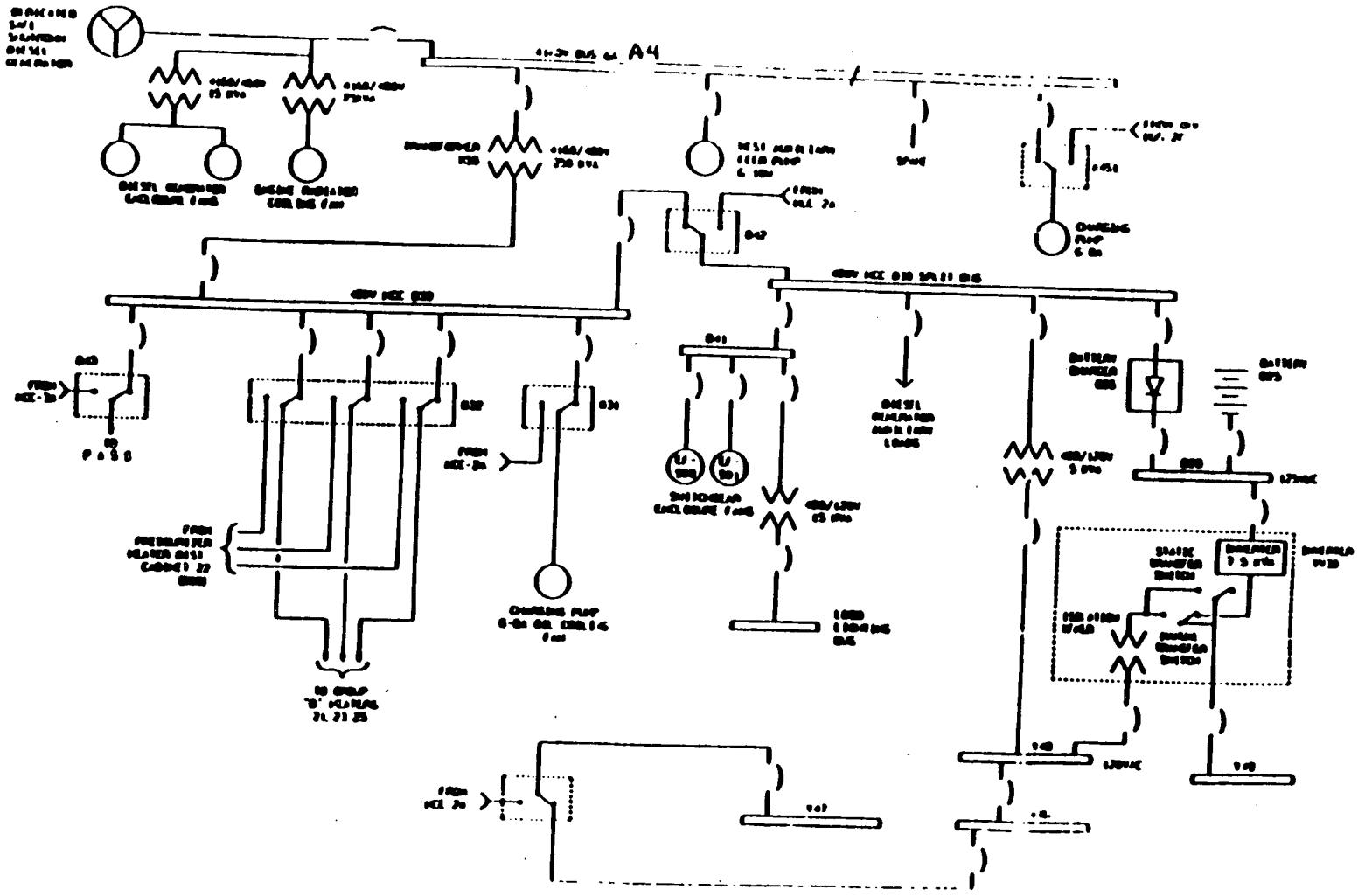


FIGURE 2. SONGS I ALTERNATE AC POWER SYSTEM

licensee needs to demonstrate and maintain a 0.95 reliability for the AAC power source. The licensee stated (13) that a time and man power study of implementing the Appendix R procedures showed that the DSD diesel can be brought on line within 20 minutes of the onset of an SBO, and that a new timed test will be performed during the next refueling outage. The licensee needs to perform and document the above test to demonstrate that the safe shutdown equipment can be powered within one hour of an SBO event.

3.3 Station Blackout Coping Capability

The plant coping capability with a station blackout for the required duration of four hours is assessed based on the following results:

1. Condensate Inventory for Decay Heat Removal

Licensee's submittal

The licensee stated (13) that the SONGS 1 Technical Specifications requires a minimum condensate storage tank level of 190,000 gallons and that 40,262 gallons are required to remove decay heat during a 4-hour SBO event. This analysis used a combination of the one hour and four hour sensitivity factors from NUMARC 87-00, Section 7.2.1. The licensee stated that the use of a combination of sensitivity factors may be a deviation from the NUMARC 87-00 guidance. The licensee stated that no modifications or procedural changes are necessary to use these water sources.

Review of Licensee's Submittal

The licensee proposes to use a motor-driven AFW pump powered from DSD diesel when the AAC power source is established. During the first hour SONGS 1 uses the turbine-driven AFW pump to supply condensate to the steam generators to remove decay heat. The licensee initially calculated (12) the condensate requirements for

only one hour even though the required coping duration is four hours. In the supplemental submittal (13) the calculation was revised to account for the condensate requirements for four hours.

The licensee estimated the condensate requirements (40,262 gallons) to remove decay heat by considering the operation of the turbine-driven AFW pump for one hour, and the operation of the DSD diesel powered motor-driven AFW pump for the remaining three hours. The licensee stated that the guidance provided in NUMARC 87-00, Section 7.2.1 was used. However, since NUMARC 87-00 does not provide an expression for split operations, the licensee calculated the condensate requirements for one hour (10,466 gallons), and for four hours (29,796 gallons) using the plant's design power level of 1,347 MWt, and added the results together to estimate the total required condensate. The licensee called this "a combination of sensitivity factors." Although this method is not correct, it produces a conservative result.

Using NUMARC 87-00, Section 7.2.1, and the plant's design power level of 1,347 MWt, the plant would need ~30,000 gallons of condensate to remove decay heat for four hours. SONGS 1 has a minimum of 190,000 gallons of condensate per plant technical specifications. The remaining condensate volume is adequate for any cooldown and for the subsequent recovery. Therefore, we agree with the licensee that the minimum CST level ensures adequate condensate water for coping with an SBO with a duration of four hours.

2. **Class 1E Battery Capacity**

Licensee's Submittal

In its initial submittal the licensee stated (12) that a battery capacity calculation has been performed to verify that the class 1E batteries have sufficient capacity to meet the SBO loads for

one hour. In its supplemental submittal (13), the licensee stated that the above analysis was based on the assumption that after one hour the instrumentation in the control room be shed and the control room be evacuated. The licensee acknowledged that the control room evacuation for preserving battery capacity is not consistent with the guidance and committed to re-evaluate the battery sizing calculations by June 30, 1990 (13). However, in its submittal dated August 6, 1990 (14) the licensee stated that this analysis will be completed by November 30, 1990.

Review of Licensee's Submittal

The DSD diesel generator (AAC power source) does not power the emergency buses and, hence, the station batteries can not be charged. The licensee is in process of reviewing the battery capacities to verify that the station batteries are capable of providing power to the required SBO loads including the main control room. However, since the licensee has yet to provide any analysis confirming the adequacy of the class 1E battery capacities, this item will remain open pending the NRC's acceptance of the licensee's response.

3. **Compressed Air**

Licensee's Submittal

The licensee stated that the air operated valves needed to cope with an SBO event can either be operated manually or have sufficient back-up sources that are independent of the preferred and blacked out unit's class 1E power systems. Valves requiring manual operation or that need back-up sources for operation are identified in plant procedures.

Review of Licensee's Submittal

The air-operated valves needed to cope with an SBO event are the AFW pump flow and steam control valves and the atmospheric dump valves (ADVs). The licensee stated (14) that these valves are equipped with back-up compressed nitrogen which can support the needed valve operations for up to 16 hours. According to the plant UFSAR, this back-up nitrogen is automatically available to the valves when the instrument air pressure gets below 80 psig. The UFSAR also states that the nitrogen header pressure is routinely checked and that additional bottles of compressed nitrogen are available on site to support the demand, if needed.

Based on the above, we agree with the licensee that the plant has sufficient compressed air for the operation of the air operated valves during a 4-hour SBO event.

4. Effects of Loss of Ventilation

Licensee's Submittal

The licensee stated (12) that the turbine-driven AFW pump is located in an open area under the west feedwater heater deck. Therefore the licensee concluded that the AFW pump room is not a dominant area of concern. The licensee also stated that the assumption that the control room temperature would not exceed 120°F was assessed, and concluded that the control room is not a dominant area of concern (DAC).

In its supplemental submittal (13), the licensee stated that NUMARC methodology was not used to calculate the effects of loss of ventilation in the inverter room (DC switchgear room), charging pump room, and the 480 V switchgear room. The effects of loss of ventilation in these rooms were previously evaluated under the Systematic Evaluation Program (SEP) and documented in NUREG-0829

(16). The licensee claimed that the SEP analyses are more representative evaluations of the loss of ventilation than the NUMARC method. The licensee added that a control room heat-up calculation is currently being performed and that it is expected to be completed by June 30, 1990.

In its August 6, 1990 submittal (14), the licensee stated that the control room heat-up calculation shows that the control room temperature would not exceed 120°F during an SBO event. The licensee added that, consistent with the NUMARC guidance, the doors to cabinets containing instrumentation necessary for safe shutdown will be opened within 30 minutes of the initiation of an SBO event. The licensee also stated that new heat-up calculations consistent with the NUMARC 87-00 methodology were performed for the three rooms for which the results of SEP calculations were used. The licensee added that the calculations for the charging pump room and the 480 V switchgear room indicate that the temperatures in these rooms will not exceed their maximum allowable temperatures. The calculations for the DC switchgear room will be completed by November 30, 1990.

Review of Licensee's Submittal

During the telephone conversation of June 22, 1990, the licensee agreed to provide additional information on the loss of ventilation calculations. The licensee provided (14) a list of major assumptions and input parameters which were used to calculate the control room ambient temperature during an SBO event, and stated that the final temperature after four hours would be approximately 117°F. For this calculation, the licensee used a non-NUMARC method, used a non-conservative initial control room temperature of 75°F, and assumed a constant air temperature in the surrounding rooms. Although the description of the analytic approach appears to be consistent with the NUMARC guidance, the licensee should have evaluated the final control

room temperature based on the maximum temperature limit in the control room instead of a typical value. The plant UFSAR (Section 3.11.4) indicates that the control room temperature limit is 85°F. Use of this temperature would result in a final temperature in excess of 120°F. The licensee needs to re-assess the control room heat-up calculations and provide the final analysis, along with justifications for each assumption used, to the staff for review. The licensee also needs to provide the results of the DC switchgear room calculations for review.

5. Containment Isolation

Licensee's Submittal

The licensee performed a review of the containment isolation valves (CIVs) and stated that appropriate containment integrity can be provided under SBO conditions. In its supplemental response (13), the licensee stated that it adopted the following three exclusion criteria in addition to those specified in NUMARC 87-00 and RG 1.155 for CIVs:

1. Valves that are redundant to isolation valves that meets the NUMARC exclusion criteria,

2. Valves that are "always" or "normally" closed but not "locked closed," and

3. Valves that do not meet the explicit requirements of GDC 56 but have been found acceptable by the staff under SEP program.

Review of Licensee's Submittal

In response to questions during the telephone conversation on June 22, 1990, the licensee stated (14) that the SBO procedure will be

revised to identify the procedures (i.e. SO1-4-39 and SO1-4-41) that verify that the normally closed CIVs are closed. Additionally, the licensee identified seven containment isolation valves that partially meet GDC 56 and were found acceptable by the staff as documented in Section 4.23.7 of NUREG-0829. The licensee added that procedures SO1-12.3-43 and SO1-12.3-34 provide assurance that theses valves are closed and provide for monthly surveillance of valve alignment.

We found the licensee's approach to be generally consistent with the guidance, and where the approach deviates from the guidance the licensee has identified the list of CIVs in the appropriate procedure. However, the licensee needs to provide appropriate containment integrity by ensuring that these valves are in a safe position (closed) by providing position indications (local, mechanical, or remote) independent of the preferred and class 1E AC power systems.

6. Reactor Coolant Inventory

Licensee's Submittal

The licensee stated (12) that the AAC source powers the necessary make-up systems to maintain adequate reactor coolant system (RCS) inventory to ensure that the core is cooled for the required coping duration. In its supplemental response (13), the licensee stated that no RCP seal degradation was assumed in the analysis of RCS inventory. The licensee added that the SONGS 1 RCP seals are cooled via a DC powered thermal barrier pump during the first hour of an SBO event and by an AAC powered charging pump during the remaining three hours. The licensee claimed that the combination of the DC powered thermal barrier pump and the AAC powered charging pump will assure that seal cooling is maintained and that the RCP seals will not be degraded.

Review of Licensee's Submittal

Reactor coolant makeup is necessary to replenish the RCS inventory losses due to the RCP seal leakage and the technical specification maximum allowable leakage. The licensee, in response to questions raised during the telephone conversation on June 22, 1990, stated (14) that it will provide an analysis demonstrating that the thermal barrier pump design is adequate to preclude any RCP pump seal degradation during the SBO event. Since the licensee has yet to provide the requested information, we consider the licensee's assumption to be a non-conformance and a deviation from the guidance. The licensee needs to provide an analysis demonstrating that adequate RCS inventory is maintained by considering a 25 gpm seal leak rate in addition to the maximum leak rate allowed by the plant technical specifications during plant operation.

NOTE:

"The 25 gpm RCP seal leak rate was agreed to between NUMARC and the staff pending resolution of generic Issue (GI) 23. If the final resolution of GI-23 defines higher RCP 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 plant procedures will be reviewed and modified as necessary to meet the guidelines in NUMARC 87-00, Section 4, in the areas of AC power restoration and station blackout response. The licensee stated that SONGS 1 does not have a procedure detailing operator actions prior to onset of severe weather. The licensee will

develop a severe weather response procedure in accordance with the guidelines of NUMARC 87-00, Section 4.2.1. The licensee stated that the procedure changes/modifications will be completed one year after the notification from the NRC per 10 CFR 50.63(c)(3).

Review of Licensee's Submittal

We neither received nor reviewed the affected procedures or training. These procedures are plant specific actions concerning the required activities to cope with a 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 in their contents, and that the associated training needs are carried out accordingly.

3.5 Proposed Modifications

Licensee's Submittal

The licensee stated that "minor changes" will be made as necessary to ensure operation of the AAC system under the conditions of an SBO event.

Review of Licensee's Submittal

Modifications to meet SBO guidance should be completed within two years of the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63 (c)(3). It is not clear what "minor changes" are necessary for SONGS 1. The licensee needs to provide additional information describing these changes.

3.6 Quality Assurance And Technical Specifications

The licensee did not provide any information on how the plant complies with the requirements of RG 1.155, Appendices A and B. During the telephone conversation of June 22, 1990, the licensee stated that all the SBO equipment

is covered by NRC-approved QA programs (10 CFR 50 Appendix B or Appendix R). Future NRC audits should verify that the SBO equipment is covered by appropriate QA and technical specification programs consistent with the guidance of RG 1.155, Appendices A and B.

4.0 CONCLUSIONS

Based on our review of the licensee's submittals, a telephone conversation between NRC/SAIC and the licensee, and the information available in the UFSAR for the SONGS 1 Nuclear Power Station, we find the submittal conforms with the requirements of the SBO rule and the guidance of RG 1.155 with the following exceptions:

1. **Class 1E Battery Capacity**

   The DSD diesel generator (AAC power source) does not power the emergency buses, therefore the station batteries can not be charged during an SBO event. The licensee has yet to provide an analysis demonstrating the adequacy of the class 1E battery capacity to power the required SBO loads including the main control room.

2. **Effects of Loss of Ventilation**

   The licensee revised the heat-up calculations for the main control room, DC switchgear room, charging pump room, and the 480 V switchgear room. In the control room heat-up calculations, the licensee used a non-conservative initial room temperature of 75°F, resulting in a final temperature of 117°F. The licensee needs to provide justifications on why the control room temperature would not exceed 75°F, or re-evaluate the control room heat-up calculations considering an initial room temperature which is consistent with the maximum allowed technical specification temperature for this room. The licensee also needs to provide the results of the heat-up calculations for the DC switchgear room for the staff's review.

4. **Containment Isolation**

The licensee identified the CIVs which deviate from the exclusion criteria given in RG 1.155 and NUMARC 87-00. The licensee stated that these valves will be added to the plant SBO procedure.. The licensee needs to ensure that these valves are in a safe (closed) position during an SBO event by providing position indication (i.e. local, mechanical or remote) independent of the preferred and class 1E AC power systems.

5. **Reactor Coolant Inventory**

The licensee stated the analysis of the RCS inventory did not consider any RCP seal leak rate. The licensee claimed that with the operation of a DC powered thermal barrier pump during the first hour, prior to the start of an AAC powered charging pump, no RCP seal degradation is expected. However, the licensee is yet to provide an analysis showing that the DC powered thermal barrier pump is adequate to preclude RCP seal degradations. The licensee needs to provide such analysis, or show that adequate RCS inventory will be maintained by assuming a 25 gpm seal leak rate per pump in addition to technical specification allowed RCS leakage during plant operation.

6. **Proposed Modifications**

The licensee stated that "minor changes" will be made as necessary to ensure operation of the AAC system under the conditions of an SBO event. It is not clear what "minor changes" are necessary for SONGS 1. The licensee needs to provide information describing these changes.

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.

2. U.S. Nuclear Regulatory Commission, "Evaluation of Station Blackout Accidents at Nuclear Power Plants - Technical Findings Related to Unresolved Safety Issue A-44," NUREG-1032, Baranowsky, P. W., June 1988.

3. U.S. Nuclear Regulatory Commission, "Collection and Evaluation of Complete and Partial Losses of Offsite Power at Nuclear Power Plants," NUREG/CR-3992, February 1985.

4. U.S. Nuclear Regulatory Commission, "Reliability of Emergency AC Power System at Nuclear Power Plants," NUREG/CR-2989, July 1983.

5. U.S. Nuclear Regulatory Commission, "Emergency Diesel Generator Operating Experience, 1981-1983," NUREG/CR-4347, December 1985.

6. U.S. Nuclear Regulatory Commission, "Station Blackout Accident Analyses (Part of NRC Task Action Plan A-44)," NUREG/CR-3226, May 1983.

7. U.S. Nuclear Regulatory Commission Office of Nuclear Regulatory Research, "Regulatory Guide 1.155 Station Blackout," August 1988.

8. Nuclear Management and Resources Council, Inc., "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00, November 1987.

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