UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATE AC SOURCE - BLACKOUT MODIFICATIONS

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NOS. 1 AND 2

DOCKET NOS. 50-313 AND 50-368

1.0 INTRODUCTION

The NRC staff's Safety Evaluation (SE) and Supplemental Safety Evaluation (SSE) pertaining to the Entergy Operations' (the licensee's) responses to the Station Blackout (SBO) Rule, 10 CFR 50.63, was transmitted to the licensee by letters dated October 10, 1990, and October 24, 1991, respectively. The staff's SSE accepted the licensee's proposed use of a new diesel generator as an alternate AC (AAC) power source for coping with an SBO subject to confirmation that the AAC source would have the capacity and capability to power the Class 1E battery charger(s) and the necessary reactor coolant inventory equipment. The licensee confirmed these two items by letter dated November 26, 1991. Subsequently, by letter dated August 14, 1992, the licensee submitted the conceptual design for staff review.

2.0 AAC POWER SOURCE REQUIREMENTS

The requirements of an AAC power source are specified in 10 CFR 50.2 and 10 CFR 50.63. Further guidance is provided in Regulatory Guide (RG) 1.155 and NUMARC 87-00, Appendix B. The 10 CFR requirements are that the AAC power source (1) is connectable to but not normally connected to the offsite or onsite emergency ac power systems, (2) has minimum potential for common mode failure with offsite power or the onsite emergency power system, (3) is available in a timely manner, and (4) has sufficient capacity and reliability for operation of all systems required for coping with station blackout and for the time required to bring and maintain the plant in safe shutdown (non-design basis accident). NUMARC 87-00, Appendix B, Paragraphs B.1 through B.13 has been endorsed in RG 1.155 by the NRC staff and provides specific guidelines for meeting the above requirements. The following evaluation refers frequently to these guidelines.

3.0 EVALUATION

3.1 General Description

The licensee proposes to install a 4000 Kw non-class 1E diesel generator as an AAC source for SBO. The AAC source would be connectable to a new 4160 V bus (2A9). This 2A9 bus would be connectable to any of the four Arkansas Nuclear One (ANO) safety buses (A3, A4, 2A3, or 2A4) and to two of the non-safety

ouses (A1 or 2A1) (see Figure 1). The diesel generator, its supporting systems, and its associated switchgear would be housed in a new diesel generator building. A new 480 V motor control center (MCC) (2Sxxx) and an associated 4160/480 V transformer would also be installed in the new building. 480 V MCC would power the AAC source supporting systems and house loads , ventilation, etc.) in the new building. A connection to an 13.8 kV/480 V transformer would be made to power the 480 V MCC during (non-blackout) conditions (see Figure 1). The proposed AAC power s s not an identical machine to the emergency onsite AC power source, t oviding diversity. The staff finds this to be consistent with NUMARC Part B.8(d).

. Auxiliary and Support Systems

The AAC auxiliary and support systems consists of the AAC fuel oil subsys the starting air subsystem, the service air subsystem, the air intake and exhaust subsystem, the engine water cooling subsystem, the heating, ventilation and air conditioning (HVAC) subsystem, lubrication subsystem, and the electrical auxiliary equipment. The air starting system will consist of two independent and redundant starting air receiver sets supplied by a common compressor. Each air receiver set will have the capability of five cold start attempts without recharging the air receivers. Thus, the AAC system is equipped with a start system that is ndent of the preferred and blacked-out unit's referred and Class 1E power supplies. The staff finds this to be consistent with NUMARC 87-00, Part B.8(b).

The lube oil system for the AAC source will allow for seven days of operation at rated load without operator action. Thus, the AAC system is equipped with a lube oil system that is independent of the preferred and blacked-out unit's preferred and Class 1E power supplies. The staff finds this to be consistent with NUMARC 87-00, Part B.8.

Each of the subsystems, except to the extent that they interface with the existing fuel oil storage system, and electrical systems, are housed within the new switchgear building which will be constructed to conform with the Uniform Building Code. Cables interfacing with existing electrical systems will be run within buried cable ducts or within the turbine building. Based on the above, the staff concludes that the AAC power system and subsystems are protected against the effects of likely weather events that may initiate the loss of offsite power (LOOP) event, and are therefore consistent with the guidelines of NUMARC 87-00, Part B.3.

The fuel oil system for the AAC source will contain its own fuel oil day tank, fuel oil transfer pump, and main fuel oil solenoid operated transfer valve. The fuel oil supply will interface with the existing shared bulk storage tank T-25. Although T-25 is a common storage tank for the onsite emergency AC (EAC) power system, it is not part of the safety related fuel oil supply/storage for the EAC power system. Therefore, the required independence of the AAC power system is maintained. The fuel level in the T-25 tank will

be administratively controlled to maintain a minimum of 4-1/2 days of fuel for the AAC generator considering other users that could be operated at the same time. Also, any delivered fuel oil will be sampled and analyzed consistent with applicable standards prior to transfer into T-25. Additionally, the contents of T-25 will be periodically sampled. Based on the above, the staff concludes that the fuel oil supply system is separate from the fuel oil supply for the onsite emergency AC (EAC) power system. The staff finds this to be consistent with NUMARC 87-00, Part B.8 (c).

The AAC power system will interface electrically with the existing offsite and onsite ac power systems. However, electric isolation is provided between the systems by two breakers in series (see Figure 1). Based on the above, the staff concludes that failure of AAC components will not adversely affect the Class 1E ac power systems. The staff finds this to be consistent with NUMARC 87-00, Part B.5. Also, electrical isolation is provided through an appropriate isolation means. The staff finds this to be consistent with NUMARC 87-00, Part B.6.

The AAC power system will receive 125 V DC power from the Unit 2 black battery 2D13 (non-1E) or a new local 125 V DC battery (to be determined later) for AAC control circuits, the motor driven fuel oil pump, the lube oil auxiliary pump, and diesel generator field flashing. Based on the above, the staff concludes that the AAC power system will be equipped with a DC power source that is electrically independent from the blacked-out unit's preferred and Class 1E power supply. The staff finds this to be consistent with NUMARC 87-00, Part B.8 (a).

The HVAC subsystem will maintain the temperature in the AAC generator room within the 120°F ambient design basis. The switchgear room will normally be maintained between 65°F and 85°F. If air conditioning fails, an exhaust fan would maintain the temperature between the extremes of 40°F and 105°F. The staff finds this to be acceptable.

Instrumentation will be located locally (near the AAC generator) to monitor the status of the fuel oil, AAC starting air, AAC air intake and exhaust, engine cooling water, AAC HVAC, and AAC lubrication subsystems. Instrumentation will be provided locally and in the ANO-2 control room to annunciate abnormal, pre-trip and trip conditions of the AAC system. Voltage and frequency sensing devices with indication in the control room will be provided to prevent connecting the AAC power source to the safety bus until rated voltage and frequency are obtained on the AAC generator. Instrumentation will also be provided in the control room to permit synchronizing the AAC generator with the non-safety buses (A1 and 2A1) for performance testing and peaking. The staff finds this to be acceptable.

From the above analysis of the AAC generator subsystems and supporting systems, the staff concludes that the AAC power system will be capable of operating during and after an SBO without any support systems powered from the preferred power supply or the blacked-out unit's Class 1E power sources

affected by the event. The staff finds this to be consistent with NUMARC 87-00, Part B.8(f). Also, the staff concludes that the proposed AAC power source will not have a single point vulnerability whereby a likely weather related event or single active failure could disable any portion o the on-site EAC power sources or the preferred power sources, and simultaneously fail the AAC power source. The staff finds this to be consistent with NUMARC 87-00, Part B.8(e).

3.3 AAC Performance Requirements

The AAC generator system will not be Class 1E or seismically qualified. This is consistent with NUMARC 87-00, Parts B.1 and B.2, and is therefore acceptable. The AAC generator system will be of sufficient capacity and capability to replace the function of one of the four 1E diesel generators and will therefore be capable of carrying the required shutdown loads for the required coping duration. The staff finds this to be consistent with NUMARC 87-00, Part B.9. The AAC unit will start on a remote manual start signal from the Unit 2 control room (for SBO on Unit 1, start up will be requested by the Unit 1 operators). The AAC unit will accelerate to rated speed, establish rated voltage, and be manually connected to the selected 4160 V Class 1E bus. This is consistent with NUMARC 87-00, Part B.7, in that the AAC source is not normally connected to the preferred or on-site EAC system. After the AAC source is connected (manually) to the EAC bus, and the bus becomes energized, the required emergency shutdown loads will automatically sequence onto the bus. In the absence of a safety injection signal, only the 480 volt safety related load center and the service water pump will sequence to the AAC power source. This is consistent with NUMARC 87-00, Part B.7, in that automatic sequencing of the loads will not occur until the bus is manually re-energized following the loss of offsite power.

3.4 Testing and Maintenance

The AAC generator will be started and loaded to the maximum SBO load at a minimum of once every three months. Once every 18 months, a timed start (within 10 minutes) and rated load capacity test will be performed. The staff finds these tests to be consistent with NUMARC 87-00, Part B.10. The licensee stated that all testing and surveillance requirements that presently apply to the Class 1E emergency diesel generators (EDGs) will be applied to the AAC power source. The staff considers this to be consistent with NUMARC 87-00, Part B.11, pertaining to surveillance and maintenance procedures. Although the licensee stated that testing will meet the guidelines of NUMARC 87-00 as a minimum, it did not specifically state that the AAC generator will be demonstrated by an initial test to be capable of powering the required shutdown equipment, consistent with NUMARC 87-00, Part B.12. The licensee should commit to this test.

3.5 Quality Assurance

The licensee states that the AAC system will be designed, constructed, tested and maintained as a "Non-Q" system conforming to the augmented QA requirements based on Regulatory Guide (RG) 1.155. The staff accepts the licensee's commitment to the RG 1.155 guidelines.

3.6 Implementation Schedule

Construction of the AAC power source is expected to be complete December 31, 1994. The unit specific tie-ins will occur during 1R11 (scheduled for the fall of 1993) and 2R10 (scheduled for the spring of 1994). The remaining modifications are to be completed during power operation. The licensee justifies the additional time required beyond 2 years specified in 10 CFR 50.63 (c)(4) based on the design, procurement and installation lead time required for the major modifications proposed.

Considering the major modifications required, i.e., the new switchgear building and new diesel generator and its support systems, and based on the time requirements for similar installations at other plants, the staff accepts the licensee's schedule for completion of the project as realistic.

4.0 SUMMARY AND CONCLUSION

The staff has reviewed the conceptual design of the AAC power source proposed by the licensee to satisfy the SBO Rule requirements of 10 CFR 50.63. The staff finds the conceptual design to be acceptable subject to confirmation from the licensee that an initial test will be made of the AAC power source consistent with the guidelines of NUMARC 87-00, Part B.12. The staff has also accepted the licensee's proposed schedule of December 31, 1992, for implementing the SBO Rule.

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SIMPLIFIED ONE-LINE DIAGRAM
ARKANSAS NUCLEAR ONE - AAC POWER SOURCE

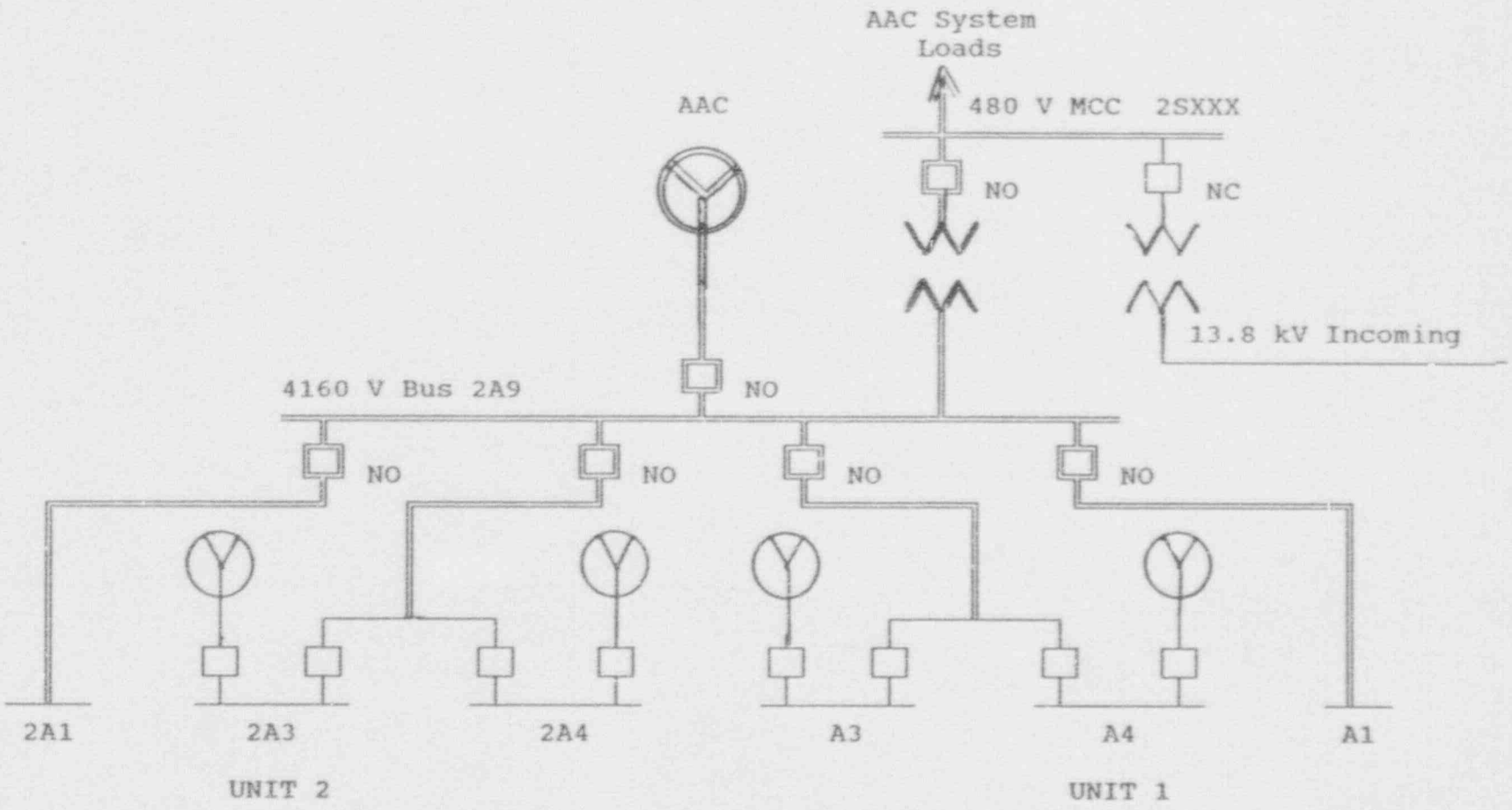

FIGURE 1