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October 15, 2001

2CAN100111

U. S. Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, DC 20555

Subject: Arkansas Nuclear One – Unit 2
Docket No. 50-368
License No. NPF-6
Request for Additional Information on Proposed Change to Modify Emergency Diesel Generator Surveillances

Gentlemen:

By letter dated June 12, 2001 (2CAN060102), Entergy Operations, Inc. (Entergy) proposed a change to the Arkansas Nuclear One-Unit 2 (ANO-2) Technical Specification (TS) Surveillance Requirements (SRs) that relate to the emergency diesel generators (EDGs). The proposed change modifies several of the EDG SRs to allow their performance in modes other than shutdown. On July 24, 2001, and August 7, 2001, Entergy and members of your Staff held telephone calls to discuss specific electrical system questions and comments. Please find in Attachment 1 Entergy's response to the information requested by your Staff.

Additionally, several editorial changes are being made to the originally submitted TS pages. An administrative change is proposed to TS 6.9.1.5.a which changes the word "form" in the last sentence of the TS to "from." A slight modification to the TS Bases page (Attachment 3) is proposed to re-insert "and" which was inadvertently deleted in the third line of the fourth paragraph. The proposed change associated with TS SR 4.8.1.1.1.b is being withdrawn. The proposed change to SR 4.8.1.1.1.b was an administrative change to correct a typographical error. However, the NRC controlled copy of the TSs reflected the correct verbiage for this SR.

Although the above administrative changes are the only modifications to the original proposed changes, all the pages associated with this request are included for convenience. Technical changes are not proposed nor are any new commitments introduced in response to the request for additional information. The No Significant Hazards Considerations contained in the original submittal is not affected by these changes.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on October 15, 2001.

Very truly yours,

Glenn R. Ashley
Manager, Licensing

GRA/dm
Attachments

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ATTACHMENT 1

TO 2CAN100111

REQUEST FOR ADDITIONAL INFORMATION

MODIFICATION TO ANO-2 EMERGENCY DIESEL GENERATOR

SURVEILLANCE REQUIREMENTS

Request for Additional Information

Modification to ANO-2 Emergency Diesel Generator Surveillance Requirements

Question 1:

The proposed change to Technical Specification (TS) 4.8.1.1.2.c.1 will delete the requirement to subject the emergency diesel generator (EDG) to an inspection in accordance with the procedures prepared in conjunction with its manufacturer's recommendations. Please indicate that plant procedures include the requirement that the EDGs will be inspected in accordance with procedures prepared in conjunction with its manufacturer's recommendations, and any changes to these procedures will be subject to a 10 CFR 50.59 review.

Response:

The manufacturer's recommended inspections are included in plant procedures, which are subject to a 10 CFR 50.59 review if any changes are proposed.

Question 2:

TS 4.8.1.1.2.c.9 requires that during the first two hours of the 24-hour endurance run of the EDGs, the EDGs are loaded to an indicated 3000 to 3200 kW (the 2-hour rating) during the first 2 hours of the test. The proposed change will allow the test at the 2-hour rating to be performed at anytime during the endurance run. Explain why loading to the 2-hour rating in the first 2 hours of the endurance run is detrimental to the EDG. Also, provide relevant manufacturer recommendations, if available, that indicate that loading to the 2-hour rating in the first 2 hours of the endurance run is detrimental to the EDG.

Response:

ANO's position is that the engine is fully capable of operating at 110% (3100 –3200 kW) during the first two hours of the 24 hour endurance run. By performing a 2 hour 110% load run, ANO proves the EDG is physically capable of producing and carrying 110% of rated load. This means that the engine has sufficient fuel rack movement, the governor can control speed at 110%, the excitation system can control voltage, etc.

However, reducing stress and wear on the engine is a valid consideration when testing an EDG. Moving the 110 % load portion of the endurance run to later in the test helps to reduce engine stress and wear. During the start of the 24 hour endurance run, ANO manually loads the engine to 110% of rated load in ~700 kW increments with a 5 minute wait at each increment. This loading sequence takes approximately 15 to 20 minutes depending on initial loads on the safety bus. At this point the engine is warm, but ANO

does not consider the engine condition and temperatures to be fully stabilized. Stabilized piston skirt temperatures and crankshaft bearing temperatures are especially important when operating at high loads.

Regulatory Guide 1.9 Revision 3 (*Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants*) states in sections 2.2.1 (Start Test) and 2.2.2 (Load Run Test) that the EDG can be brought up to speed and rated load by "a prescribed schedule that is selected to minimize stress and wear on the diesel generator." It is ANO's position that moving the 2 hour 110% loaded test from the first two hours to later in the 24 hour run also "minimizes stress and wear" on the engine and extends engine life.

In Generic Letter 84-15 (*Administration of Operating Tests Prior to Initial Criticality*), the NRC staff directed utilities to reduce the number of cold fast starts on EDGs that contributed to "premature diesel engine degradation." Again, in order to prolong engine life, it is desired to reduce stress on the engines as much as possible. It is ANO's position that moving the 110% overload test to later in the 24-hour run helps reduce engine stress.

INPO Significant Event Report (SER) 2-01 describes the catastrophic failure of an EDG at Seabrook station. Although the type of EDG at Seabrook (Pielstick) is different from ANO's (Opposed Piston), the manufacturer of the two engine types is the same (Fairbanks Morse). The Seabrook EDG failed during a 24 hour run. The failure occurred during the fourth attempt to complete a 24-hour load run test. Seabrook's investigation into the EDG failure revealed that the number 7 cylinder failed because of rubbing between the aluminum piston skirt and the cast iron cylinder liner. The failure was attributed to non-uniform thermal expansion of the piston skirt, which resulted in scoring and transfer of metal onto the cylinder liner. The station also was aware of industry operating experience involving diesel generator failures and recommendations made to minimize failures caused by excessive testing. However, no changes were made to the EDG operating and surveillance procedures to incorporate a less demanding testing methodology. All EDG operability tests at the station were in accordance with station technical specification requirements, which consisted of fast starts and loading to 110 percent of rated load. The load was applied over approximately 10 minutes after breaker closure, in accordance with the procedure. Additionally, when testing to 110 percent of rated load during 24-hour full-load testing, the maximum load was applied at the beginning of the test, as required by the technical specifications rather than at the end. Diesel generator manufacturers recommend testing at high loads near the end of a test run, rather than at the beginning. It is ANO's position that the manufacturer's recommendations to impose the high loads later in the test run be followed to help extend engine life.

The Fairbanks Morse Company was contacted to determine their position on 110% loading of the opposed piston engine during a 24-hour endurance run. Fairbanks Morse responded that it was desirable to conduct the 110% load portion of the endurance run later in the test to ensure engine pressures and temperatures are stabilized. This will

enhance engine reliability and extend engine component life. The following is the manufacturer's response:

> "In response to your verbal request for FM recommendations for operation @ 100% and 110% load, please be advised that although the engine is capable of operation initially at 110%, the preferred operation is initially at 100% operation, then increase the load to 110% after engine operating temperatures and pressures stabilize.
>
> The engines have demonstrated over many years of operation with fast starts/fast loads that they can tolerate this regime of operation. However, fast starts/loads create increased pressures/temperatures in the combustion chamber while the cooling systems and engine components are operating at lower keep warm temperatures. These gradients accelerate wear and provide an increased opportunity for engine distress.
>
> Again, this is not a condemnation of fast start/load operation, but rather a preference that will enhance engine reliability by optimizing engine operating conditions and extending the life of components."

In conclusion, ANO will continue to perform 24-hour endurance runs on the Unit 2 Fairbanks Morse opposed piston engines, including a 2 hour 110% load test. However, based upon a review of the documents listed above, industry operating experience and the manufacturer's recommendation, it is desirable to perform the 2 hour 110% portion of the test near end of the 24-hour endurance run. This will help ANO extend component life and maintain high equipment reliability during future operation and testing of the EDGs.

Question 3:

It is also proposed that TS 4.8.1.1.2.c.9 be revised to remove the "during shutdown" requirement related to performing the 24-hour endurance run on the EDGs. Explain how the EDG output breaker responds to a loss of offsite power. Also, indicate where the loss of offsite power signal comes from when the EDG is powering the safety bus.

Response:

Please refer to ANO-2 Safety Analysis Report (SAR) Figures 8.3-49 (E-2100, Sheet 1A), 8.3-49 (E-2100, Sheet 2), and 8.3-5 (E-2005, Sheet 1). SAR Figure 8.3-5 (E-2005, Sheet 1) provides a general layout of the 4160VAC safety buses. SAR Figure 8.3-49 (E-2100, Sheet 1A) provides a schematic of the EDG 2K4B output breaker, 2A408. SAR Figure 8.3-49 (E-2100, Sheet 2 of 2) provides a schematic of the EDG lockout relays.

Only EDG "B", 2K4B will be described in this response, however, EDG "A", 2K4A is identical.

EDG 2K4B feeds bus 2A4 through 2A408, the EDG Output breaker. Offsite power is supplied to 2A4 via breaker 2A409. This breaker (2A409) ties the non-Q 4160 V (2A2) to 2A4. The main generator, startup or unit auxiliary transformers are connected to 2A2 through individual breakers.

SAR Figure 8.3-49, Sheet 1A (E-2100, Sheet 1A) shows the close and trip circuitry for the output breaker of 2K4B. The far right leg of the circuit shows the "Unit Trip During DG Test." This leg is made up of four contacts, which if closed will energize the trip coil of the EDG output breaker. The upper and lower contacts (152-408/a and 152-409/a) will both be closed when the EDG is in parallel with offsite power (i.e., in the test mode). The other two contacts in this portion of the circuit are in parallel with each other. One of them (K409) closes upon receipt of an SIAS actuation. This contact (K409) is shown in the accident condition on the drawing. The other parallel contact (152-408/X1-1A/1B) closes upon receipt of a main generator lockout, as is shown in SAR Figure 8.3-49 (E2100, Sheet 2).

SAR Figure 8.3-49 (E-2100, Sheet 2) shows 152-408/X1 relay. When this relay energizes, the associated contact 152-408/X1-1A/1B shown on SAR Figure 8.3-49, Sheet 1A closes and trips the EDG output breaker. 152-408/X1 is energized when the Unit Auxiliary Transformer is supplying the site via the main generator (contact 152-212/a closed) and a main generator lockout occurs (DC powered contacts 286-G2-2 or 286-G2-4 close). A main generator lockout can be generated from any of the following: turbine trip, main transformer failure (sudden pressure), unit auxiliary transformer failure (sudden pressure, differential, over current), generator problems (loss of field, volts/hz, differential, etc.), or main generator output breaker failure.

The 152-408/X1 relay can also energize when EDG 2K4B is paralleled with offsite power and the plant auxiliary buses are being supplied from either startup transformer #2 or #3. In this condition, the startup transformer lockout will energize the 152-408/X1 relay which in turn causes the 152-408/X1-1A/1B contact to close and the EDG output breaker to trip open.

The loss of offsite power event combined with the EDG output breaker opening results in actuation of the under voltage (UV) relays. These relays will cause the 2A409 breaker to trip, thus isolating the 2A4 bus from offsite power. The 152-409/b contact (see SAR figure 8.3-49 E2100 Sheet1A) closes when 2A409 is open. This completes the circuit to allow the EDG output breaker to re-close, energizing 2A4 from the EDG.

The main generator is connected to the offsite power grid through the main generator output breakers. Offsite power is supplied to the plant buses from the generator through the Unit Auxiliary Transformer or from Startup Transformer #2 or #3. The loss of offsite power signal, as related to ANO-2 TS, is by actuation of either the Degraded Voltage Relays or the Loss of Voltage Relays, as described in ANO-2 SAR Chapter 8 and TS Section 3.3. These relays will start the EDG and separate the safety bus from the offsite power source when the loss of power is detected. They do not perform actions when the

EDG is powering the safety bus. ANO-2 does not have a specific "loss of offsite power signal" when the EDG is powering the safety bus. However, when both the EDG and the offsite power are connected to the safety bus, the loss of offsite power condition is indicated by either actuation of the Generator Lockout Relay (which will result in tripping the Generator and Generator breakers) or actuation of either of the offsite power startup transformer Lockout Relays (which will result in tripping of the feeder breakers from the sources), provided the respective auxiliary bus feeder breaker is closed. Such condition, as described above, will result in tripping the EDG output breaker.

ATTACHMENT 2

REVISED MARKUP OF TECHNICAL SPECIFICATION PAGES

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each of the above required independent circuits between the offsite transmission network and the onsite Class 1E distribution system shall be:

a. Determined OPERABLE at least once per 7 days by verifying correct breaker alignments, indicated power availability, and

b. Demonstrated OPERABLE at least once per 18 months during shutdown by transferring (manually and automatically) unit power supply from the normal circuit to the alternate circuit.

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE: (Note 1)

a. ~~In accordance with the frequency specified in Table 4.8-1~~ At least once per 31 days on a STAGGERED TEST BASIS by:

1. Verifying the fuel level in the day fuel tank.

2. Verifying the fuel level in the fuel storage tank.

3. Verifying the fuel transfer pump can be started and transfers fuel from the storage system to the day tank.

4. Verifying the diesel starts from a standby condition and accelerates to at least 900 rpm in $\leq$ 15 seconds. (Note 2)

5. Verifying the generator is synchronized, loaded to an indicated 2600 to 2850 Kw and operates for $\geq$ 60 minutes. (Notes 3 & 4)

6. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.

b. At least once per 92 days by verifying that a sample of diesel fuel from the fuel storage tank obtained in accordance with ASTM-D270-65, is within the acceptable limits specified in Table 1 of ASTM D975-74 when checked for viscosity, water and sediment.

Note 1
All planned diesel generator starts for the purposes of these surveillances may be preceded by prelube procedures.

Note 2
This diesel generator start from a standby condition in $\leq$ 15 sec. shall be accomplished at least once every 184 days. All other diesel generator starts for this surveillance may be in accordance with vendor recommendations.

Note 3
Diesel generator loading may be accomplished in accordance with vendor recommendations such as gradual loading.

Note 4
Momentary transients outside this load band due to changing loads will not invalidate the test. Load ranges are allowed to preclude overloading the diesel generators.

SURVEILLANCE REQUIREMENTS (Continued)

c. At least once per 18 months ~~during shutdown~~ by:

1. ~~Subjecting the diesel to an inspection in accordance with procedures prepared in conjunction with its manufacturer's recommendations for this class of standby service.~~Deleted

2. Verifying during shutdown that the automatic sequence time delay relays are OPERABLE at their setpoint ± 10% of the elapsed time for each load block.

3. Verifying during shutdown the generator capability to reject a load of greater than or equal to its associated single largest post-accident load, and maintain voltage at 4160 ± 500 volts and frequency at 60 ± 3 Hz.

4. Verifying during shutdown the generator capability to reject a load of 2850 Kw without exceeding 75% of the difference between nominal speed and the overspeed trip setpoint, or 15% above nominal, whichever is lower.

5. Simulating during shutdown a loss of offsite power by itself, and:

   a) Verifying de-energization of the emergency busses and load shedding from the emergency busses.

   b. Verifying the diesel starts from a standby condition on the undervoltage auto-start signal, energizes the emergency busses with permanently connected loads, energizes the auto-connected shutdown loads through the time delay relays and operates for ≥ 5 minutes while its generator is loaded with the shutdown loads.

6. Verifying during shutdown that on a Safety Injection Actuation Signal (SIAS) actuation test signal (without loss of offsite power) the diesel generator starts on the auto-start signal and operates on standby for ≧ 5 minutes.

SURVEILLANCE REQUIREMENTS (Continued)

7. Verifying during shutdown that all diesel generator trips, except engine overspeed, lube oil pressure, generator differential, and engine failure to start, are automatically bypassed upon a Safety Injection Actuation Signal.

8. Simulating during shutdown a loss of offsite power in conjunction with SIAS and:

   a) Verifying de-energization of the emergency busses and load shedding from the emergency busses.

   b) Verifying the diesel starts from a standby condition on the auto-start signal, energizes the emergency busses with permanently connected loads, energizes the auto-connected emergency (accident) loads through the Time Delay Relays and operates for ≥ 5 minutes while its generator is loaded with the emergency loads.

9. Verifying the diesel generator operates for at least 24 hours. During ~~the first~~ 2 hours of this test, the diesel generator shall be loaded to an indicated 3000 to 3200 Kw and during the remaining 22 hours of this test, the diesel generator shall be loaded to an indicated 2600 to 2850 Kw (Notes 3 & 4). Within 5 minutes after completing this 24 hour test, ~~repeat Specification 4.8.1.1.2.e.5~~ perform 4.8.1.1.2.a.4. (Note 5)

10. Verifying that the auto-connected loads to each diesel generator do not exceed the 2 hour rating of 3135 Kw.

Note 3
Diesel generator loading may be accomplished in accordance with vendor recommendations, such as gradual loading.

Note 4
Momentary transients outside this load band due to changing loads will not invalidate the test. Load ranges are allowed to preclude overloading the diesel generators.

Note 5
If this test is not satisfactorily completed, it is not necessary to repeat the preceding 24 hour test, instead, the diesel generator may be operated at 2600 to 2850 Kw until internal temperatures stabilize but not less than 2 hours, then perform test 4.8.1.1.2.~~e.5~~ a.4 within 5 minutes.

SURVEILLANCE REQUIREMENTS (Continued)

11. Verifying during shutdown the diesel generator's capability to:

    a) Synchronize with the offsite power source while the generator is loaded with its emergency loads upon a simulated restoration of offsite power,

    b) Transfer its loads to the offsite power source, and

    c) Proceed through its shutdown sequence.

12. Verifying during shutdown that with the diesel generator operating in a test mode (connected to its bus), a simulated safety injection signal overrides the test mode by (1) returning the diesel generator to standby operation and (2) automatically energizes the auto-connected emergency (accident) loads with offsite power.

13. Verifying that the fuel transfer pump transfers fuel from each fuel storage tank to the day tank of each diesel via the installed cross connection lines.

d. At least once per 10 years or after any modifications which could affect diesel generator interdependence by starting both diesel generators simultaneously, during shutdown, and verifying that both diesel generators accelerate to at least 900 rpm in ≤ 15 seconds.

~~4.8.1.1.3 Reports — See Specification 6.9.1.5.d.~~ Deleted

~~TABLE 4.8-1~~

~~DIESEL GENERATOR TEST SCHEDULE~~

~~Number of Failures In Last 20 Valid Tests*~~	~~Number of Failures In Last 100 Valid Tests*~~	~~Test Frequency~~
~~≤ 1~~	~~≤ 4~~	~~At least once per 31 days~~
~~≥ 2~~	~~≥ 5~~	~~At least once per 7 days**~~

~~*Criteria for determining number of failures and number of valid tests shall be in accordance with Regulatory Guide 1.108, where the last 20/100 tests are determined on a diesel generator unit basis.~~

~~**This test frequency shall be maintained until seven consecutive failure free demands have been performed and the number of failures in the last 20 valid demands has been reduced to one or less and the number of failures in the last 100 valid demands has been reduced to four or less.~~

ANNUAL REPORTS [1/]

6.9.1.4 Annual reports covering the activities of the unit as described below for the previous calendar year shall be submitted prior to March 1 of each year. The initial report shall be submitted prior to March 1 of the year following initial criticality.

6.9.1.5. Reports required on an annual basis shall include:

a. A tabulation on an annual basis for the number of station, utility and other personnel (including contractors) receiving exposures greater than 100 mrem/yr and their associated man rem exposure according to work and job functions,[2/] e.g., reactor operations and surveillance, inservice inspection, routine maintenance, special maintenance (describe maintenance), waste processing, and refueling. The dose assignment to various duty functions may be estimates based on pocket dosimeter, TLD, or film badge measurements. Small exposures totalling less than 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the total whole body dose received ~~form~~from external sources shall be assigned to specific major work functions.

b. The complete results of steam generator tube inservice inspections performed during the report period (reference Specification 4.4.5.5.b).

c. Documentation of all challenges to the pressurizer safety valves.

d. ~~A diesel generator data report which provides the number of valid tests and the number of valid failures for each diesel generator.~~Deleted

e. The results of specific activity analysis in which the primary coolant exceeded the limits of Specification 3.4.8. The following information shall be included: (1) Reactor power history starting 48 hours prior to the first sample in which the limit was exceeded; (2) Results of the last isotopic analysis for radioiodine performed prior to exceeding the limit, results of analysis while limit was exceeded the results of one analysis after the radioiodine activity was reduced to less than limit. Each result should include date and time of sampling and the radioiodine concentrations; (3) Clean-up system flow history

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1/ A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the station.

2/ This tabulation supplements the requirements of §20.407 of 10 CFR Part 20.

ATTACHMENT 3

REVISED MARKUP OF TECHNICAL SPECIFICATION BASES

BASES

The OPERABILITY of the A.C. and D.C. power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety-related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix "A" to 10 CFR 50.

The ACTION requirements specified for the levels of degradation of the power sources provide restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the accident analyses and are based upon maintaining at least one redundant set of onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source. ACTION requirements are consistent with Generic Letter 84-15, "Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability" and the Revised Standard Technical Specifications (NUREG 1432). The evaluation of a common cause failure (degradation that may affect the OPERABILITY of the remaining diesel generator) should be completed within 24 hours from when the affected diesel generator is determined to be inoperable.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the unit status. Upon loss of a required power source, suspension of core alterations, the handling of irradiated fuel, and activities involving positive reactivity additions act to minimize the probability of the occurrence of postulated events. Suspension of these activities shall not preclude placing fuel assemblies in a safe position.

The Surveillance Requirements for demonstrating the OPERABILITY of the diesel generators are in accordance with the recommendations of Regulatory Guides 1.9 "Selection of Diesel Generator Set Capacity for Standby Power Supplies", March 10, 1971, and 1.108 "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants", Revision 1, August 1977, and Generic Letters 84-15, 93-05, and 94-01. Load Ranges provided in surveillances are allowed to avoid routine overloading of diesel generators. Load in excess of these load ranges for special testing, momentary variation due to changing bus loads, or short term variations shall not invalidate surveillance tests. For the purpose of surveillance testing, the term "standby condition" is defined as the approximate temperature range of the jacket cooling water and engine lube oil sump normally maintained by the engine keep warm system. An exception to this definition is the engine conditions that exist when performing the hot restart test following the 24 hour EDG endurance run. When performing this test, the engine is near normal operating temperature when in a "standby condition". Additionally, this definition includes the allowance to perform engine prelubrication prior to all planned test starts.