



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C. 20555

July 2, 1984

TO ALL LICENSEES OF OPERATING REACTORS, APPLICANTS FOR AN OPERATING  
LICENSE, AND HOLDERS OF CONSTRUCTION PERMITS

Gentlemen:

SUBJECT: PROPOSED STAFF ACTIONS TO IMPROVE AND MAINTAIN  
DIESEL GENERATOR RELIABILITY (Generic Letter 84-15)

As part of the proposed technical evaluation of Unresolved Safety Issue (USI) A-44, Station Blackout, the staff is considering new requirements that would reduce the risk of core damage from station blackout events. The reliability of diesel generators has been identified as being one of the main factors affecting the risk from station blackout. Thus, attaining and maintaining high reliability of diesel generators is a necessary input to the resolution of USI A-44.

Plants licensed since 1978 have been required to meet the reliability goals of Regulatory Guide 1.108 for their diesel generators. However, the staff has determined that many operating plants do not have reliability goals in place for their diesel generators. Considering the critical role diesel generators play in mitigating various transients and postulated events following a loss of offsite power, the staff has determined that there is an important need to assure that the reliability of diesel generators at operating plants is maintained at an acceptable level. The staff has determined that the risk from station blackout is such that early actions to improve diesel generator reliability would have a significant safety benefit. Toward this objective, we have developed the following approach to assess and enhance, where necessary, the reliability of diesel generators at all operating plants.

The items covered by this letter fall into the following three areas:

1. Reduction in Number of Cold Fast Start Surveillance Tests for Diesel Generators

This item is directed towards reducing the number of cold fast start surveillance tests for diesel generators which the staff has determined results in premature diesel engine degradation. The details relating to this subject are provided in Enclosure 1. Licensees are requested to describe their current programs to avoid cold fast start surveillance testing or their intended actions to reduce cold fast start surveillance testing for diesel generators.

2. Diesel Generator Reliability Data

This item requests licensees to furnish the current reliability of each diesel generator at their plant(s), based on surveillance test data. Licensees are requested to provide the information requested in Enclosure 2.

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### 3. Diesel Generator Reliability

Licensees are requested to describe their program, if any, for attaining and maintaining a reliability goal for their diesel generators. An example of a performance Technical Specification to support a desired diesel generator reliability goal has been provided by the staff in Enclosure 3. Licensees are requested to comment on, and compare their existing programs or any proposed program with the example performance specification.

Accordingly, pursuant to 10 CFR 50.54(f), operating reactor licensees are requested to furnish, under oath or affirmation, no later than 90 days from the date of this letter, the information requested in Items 1 through 3 above. Applicants for operating licenses and holders of construction permits are not required to respond.

Licensees may request an extension of time for submittals of the required information. Such a request must set forth a proposed schedule and justification for the delay. Such a request shall be directed to the Director, Division of Licensing, NRR. Any such request must be submitted no later than 45 days from the date of this letter.

This request for information has been approved by the Office of Management and Budget under Clearance Number 3150-0011, which expires April 30, 1985.

Sincerely,

Original signed by  
Darrell G. Eisenhut

Darrell G. Eisenhut, Director  
Division of Licensing

#### Enclosures:

1. Reduction in Number of Cold Fast Starts for Diesel Generators
2. Diesel Generator Reliability Data
3. Diesel Generator Reliability

#### DISTRIBUTION

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### 3. Diesel Generator Reliability

Licensees are requested to describe their program, if any, for attaining and maintaining a reliability goal for their diesel generators. An example of a performance Technical Specification to support a desired diesel generator reliability goal has been provided by the staff and is provided in Enclosure 3. Licensees shall comment on, and compare their existing programs or any proposed program with the example performance specification.

Accordingly, pursuant to 10 CFR 50.54(f), operating reactor licensees are requested to furnish, under oath or affirmation, no later than 90 days from the date of this letter, the information requested in Items 1 through 3 above. Applicants for an operating license and holders of construction permits are not required to respond.

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Darrell G. Eisenhower, Director  
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## ENCLOSURE 1

### REDUCTION IN NUMBER OF COLD FAST START SURVEILLANCE TESTS FOR DIESEL GENERATORS

#### Fast Start Testing

The staff has for sometime had under review and assessment methods of diesel generator testing. The staff has determined that many licensees use a method of testing which does not take into consideration those manufacturer recommended preparatory actions such as prelubrication of all moving parts and warmup procedures which are necessary to reduce engine wear, extend life and improve availability. The existing Standard Technical Specifications require fast starts from ambient conditions for all surveillance testing which in many engine designs and operating practices subject the diesel engine to undue wear and stress on engine parts. Concerns were expressed by ACRS regarding the imposition of severe mechanical stress and wear on the diesel engine due to frequent cold fast starts. Nuclear Industry related groups (INPO and American Nuclear Insurer) have also expressed concern based on operating experience that cold fast start testing results in incremental degradation of diesel engines and that, if proper procedures covering warmup prelubrication, loading/unloading etc., were taken, an improvement in reliability and availability would be gained. Similar views have been identified by the nuclear power industry and the regulatory authority in Sweden. The authority in Sweden has taken corrective actions to reduce the frequency of fast starts.

It is the staff's technical judgement that an overall improvement in diesel engine reliability and availability can be gained by performing diesel generator starts for surveillance testing using engine prelube and other manufacturer recommended procedures to reduce engine stress and wear. The staff has also determined that the demonstration of a fast start test capability for emergency diesel generators from ambient conditions cannot be totally eliminated because the design basis for the plant, i.e., large LOCA coincident with loss of offsite power, requires such a capability.

In view of the above, the staff has concluded that the frequency of fast start tests from ambient conditions of diesel generators should be reduced. An example of an acceptable Technical Specification to accomplish this goal is provided in the attachment to this enclosure. Licensees are requested to describe their current programs to avoid cold fast starts or their intended action to reduce the number of cold fast start surveillance tests from ambient conditions for diesel generators. Licensees are encouraged to submit changes to their Technical Specification to accomplish a reduction in the number of such fast starts.

#### Other Testing

Also, the staff is concerned regarding a number of additional diesel generator tests that are currently being required by Technical Specifications for some of the earlier licensed operating plants. For example, when subsystems of the emergency core cooling system on some plants are declared inoperable, the diesel generators are required to be tested. The staff has concluded that excessive testing results in degradation of diesel engines. In order to make those few plants consistent with the majority of the plants, it is the staff's position that the requirements for testing diesel generators while emergency core cooling equipment is inoperable, be deleted from the Technical Specifications for such plants. The affected licensees are encouraged to propose Technical Specifications to make such changes.

TYPICAL TECHNICAL SPECIFICATION

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 alignment, 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:

- a. In accordance with the frequency specified in Table 4.8-1 on a STAGGERED TEST BASIS by:
  1. Verifying the fuel level in the day and engine-mounted fuel tank,
  2. Verifying the fuel level in the fuel storage tank,
  3. Verifying the fuel transfer pump starts and transfers fuel from the storage system to the day and engine-mounted tank,
  4. Verifying the diesel starts from ambient condition and accelerates to at least (900) rpm in less than or equal to 10 seconds.\* The generator voltage and frequency shall be  $(4160) \pm (420)$  volts and  $(60) \pm (1.2)$  Hz within (10)\* seconds after the start signal. The diesel generator shall be started for this test by using one of the following signals:
    - a) Manual
    - b) Simulated loss of offsite power by itself.

\*The diesel generator start (10 sec) from ambient conditions shall be performed at least once per 184 days in these surveillance tests. All other engine starts for the purpose of this surveillance testing may be preceded by an engine prelube period and/or other warmup procedures recommended by the manufacturer so that mechanical stress and wear on the diesel engine is minimized.

NOTE: Bars in the margin show changes made to the Standard Technical Specifications.

## SURVEILLANCE REQUIREMENTS (Continued)

- c) Simulated loss of offsite power in conjunction with an ESF actuation test signal.
- d) An ESF actuation test signal by itself.
- 5. Verifying the generator is synchronized, loaded to greater than or equal to (continuous rating) in less than or equal to ( ) seconds,\* and operates with a load greater than or equal to (continuous rating) for at least 60 minutes.
- 6. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.
- b. At least once per 31 days and after each operation of the diesel where the period of operation was greater than or equal to 1 hour by checking for and removing accumulated water from the day and engine-mounted fuel tanks.
- c. At least once per 92 days and from new fuel oil prior to additional to the storage tanks by verifying that a sample obtained in accordance with ASTM-D270-1975 has a water and sediment content of less than or equal to .05 volume percent and a kinematic viscosity @ 40°C of greater than or equal to 1.9 but less than or equal to 4.1 when tested in accordance with ASTM-D975-77, and an impurity level of less than 2 mg. of insolubles per 100 ml. when tested in accordance with ASTM-D-2274-78.
- d. 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.
  - 2. Verifying the generator capability to reject a load of greater than or equal to (largest single emergency load) kw while maintaining voltage at  $(4160) \pm (420)$  volts and frequency at  $(60) \pm (1.2)$  Hz (less than or equal to 75% of the difference between nominal speed and the overspeed trip setpoint, or 15% above nominal whichever is less).
  - 3. Verifying the generator capability to reject a load of (continuous rating) kw without tripping. The generator voltage shall not exceed (4784) volts during and following the load rejection.

\*See footnote on previous page

## ENCLOSURE 2

### DIESEL GENERATOR RELIABILITY DATA

The reliability of diesel generators has been identified as one of the main factors affecting the risk of core damage from station blackout. Thus, attainment and continued maintenance of high reliability for diesel generators is necessary to the resolution of USI A-44. To assist the staff in assessing the current reliability of diesel generators at operating plants, licensees are requested to report the reliability of each diesel generator at their plant for its last 20 and 100 demands. This should include the number of failures in the last 20 and 100 valid demands indicating the time history for these failures. Licensees are requested to indicate whether they maintain a record which itemizes the demands and failures experienced by each diesel generator unit, in the manner outlined in Regulatory Guide 1.108 position C.3.a, for each diesel generator unit. Licensees should also indicate whether a yearly data report is maintained for each diesel generator's reliability. The criteria for determining the reliability of diesel generators is as follows:

- a. Valid demands and failures are to be determined in accordance with the recommendations of Regulatory Guide 1.108 position c.2.e.
- b. The reliability of each diesel generator will be calculated based on the number of failures in the last 100 valid demands.

## ENCLOSURE 3

### DIESEL GENERATOR RELIABILITY

In the staff's ongoing program to resolve USI A-44, Station Blackout, diesel generator reliability is one of the factors used to determine the length of time a plant should be able to cope with a station blackout. If all other factors are constant, the higher reliability of the diesel generator will result in the lower probability of a total loss of AC power. Maintaining diesel generators at or above specific reliability levels is assumed in the development of the resolution of USI A-44. The reliable operation of diesel generators should be assured by a reliability program designed to monitor, improve (if necessary), and maintain reliability at a specified level.

In view of the above, licensees are requested to describe their diesel generator reliability improvement program, if any, for attaining and maintaining a reliability goal. The program description should address the surveillance and testing the licensee performs to demonstrate the selected diesel generator reliability. All licensees have received the staff's previous letter transmitting the findings of NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability, February 1979" identifying areas where diesel generator operational problems were occurring in general. Licensees should consider the recommendations of NUREG/CR-0660 in their reliability program. The staff has developed an example for a diesel generator performance Technical Specification to support the maintenance of diesel generator reliability at a specified level. The proposed performance specification encompasses certain aspects of the existing requirements for surveillance testing of diesel generators stipulated in Regulatory Guide 1.108 and the qualitative recommendations of NUREG/CR-0660. This performance specification is presented, as an example, in the attachment to this enclosure. Licensees are requested to comment on and/or compare their program with the performance specification and provide comments for staff consideration in finalizing surveillance testing requirements for diesel generators.



## ATTACHMENT TO ENCLOSURE 3

### EXAMPLE OF DIESEL GENERATOR PERFORMANCE TECHNICAL SPECIFICATION

#### Background

Review of LER data gathered as part of the staff's study of USI A-44, Station Blackout, indicates the median value of diesel generator reliability at operating plants to be 0.98/demand with about 75% of diesel generators currently in service having a reliability of 0.95/demand or greater. The following is an elaboration of the example performance Technical Specification proposed to maintain reliability levels in this range:

#### Reliability Program

##### 1. Reliability Goals

The staff's proposed resolution of USI A-44 currently under development would provide guidance for plants to maintain diesel generator reliability at or above specified levels (0.95 being the minimum desired level). In order to assure that this level is achieved and maintained, a surveillance test program is necessary. Based on surveillance testing, should a diesel generator's reliability fall below a specified level, certain actions should be taken as presented in the next section.

##### 2. Reliability Level Remedial Actions

The reliability of each diesel generator is based on the number of failures in the last 100 valid demands, with appropriate remedial actions as follows. Note that "P" is defined as the probability of failure per demand per diesel.

<u>PLANT GROUP</u>	<u>RELIABILITY</u>	<u>ACTION</u>
A	$(1-P) \geq .95$	Continue surveillance testing at 31 day interval. Increase surveillance testing per Table 4.8.1 of Appendix A if the failures in the last 20 tests were $\geq 2$ .
B	$.95 > (1-P) \geq 0.90$	Increase surveillance testing per Table 4.8.1 of Appendix A and take action per Table 4.8.2 of Appendix A.
C	$(1-P) < .90$	Disqualify DG. Requalify DG in accordance with Table 4.8.2 Appendix A.

The diesel generator would remain inoperable from the time of the last failure through the period required for corrective action and until the first subsequent valid successful test is completed.

### 3. Surveillance Test Frequency

In order to meet the timeliness goal, a normal test frequency is established and a criterion for increasing the test frequency is necessary to determine whether a major degradation in reliability is indicated.

- a. Normal plant surveillance - each diesel generator unit should be tested at a frequency which is in accordance with the manufacturer's recommendations, but in no case should the time between tests be greater than 31 days.
- b. Accelerated plant surveillance - whenever a diesel generator unit has experienced two or more failures in the last twenty demands, the maximum time between tests should be reduced to seven days. This test frequency should be maintained until seven consecutive failure-free demands have been performed and the number of failures in the last 20 demands has been reduced to one or less. Two failures in 20 demands is a failure rate of 0.1, or the threshold of acceptable diesel generator performance, and hence may be an early indication of degradation of the reliability of a diesel generator. However, when considered in the light of a long history of tests, two failures in the last 20 demands may only be a statistically probable distribution of two random events. Increasing the test frequency will allow for a more timely accumulation of additional test data upon which to base judgment of the reliability of the unit.

### 4. Remedial Action Criteria

If the number of failures in the last twenty valid tests is three or more or in the last 100 valid tests is six or more, the licensee should within 14 days prepare and maintain a report describing the reliability improvement program at the facility which includes, but is not limited to; 1) the implementation of NUREG/CR-0660 recommendations, and 2) perform a reliability assessment of the offsite and onsite power system. (See Table 4.8.2 of Appendix A for details regarding action required).

### 5. Requalification Criteria

If the number of failures in the last twenty valid tests is five or more, or in the last 100 valid tests is 11 or more, the affected unit would be disqualified from nuclear service and subjected to a requalification program. A requalification program would be a series of 14 successful consecutive tests without a failure. The licensee would perform seven consecutive successful demands without a failure within 30 days of the diesel generator being restored to operable status and 14 consecutive demands without a failure within 75 days of the diesel generator being restored to operable status. Refer to Attachment 2 to Table 4.8-2 of Appendix A for criteria. Two attempts would be allowed to achieve the acceptable test series. During requalification testing, a diesel generator unit would not be tested more frequently than once in any 24-hour interval.

6. Failure to Requalify a Diesel Generator

If the diesel generator is not requalified as defined above, the unit would be declared inoperable and the action statement in the plant Technical Specification for one diesel generator inoperable should be followed immediately.

7. Diesel Generator Inoperability Limits

The staff has determined that the allowable out-of-service period for a diesel generator should be in excess of the current 72 hour Technical Specification limit, while at the same time placing a yearly limit upon the total cumulative time that a plant may operate with one of the diesel generators inoperable. By placing an individual limit on maximum inoperable time for a diesel generator and a cumulative limit of inoperability of the onsite power system, a framework is established within which flexibility is provided to allow a licensee to best optimize planned and unplanned service of diesel generators at a plant. This would limit plant risk from station blackout at the same time allowing flexibility for any given outage. Licensees may propose a total cumulative outage time for diesel generators in the Technical Specification along with the basis for the outage time chosen.

8. Valid Demands and Failures

Valid demands and failures used in the above paragraphs should be determined in accordance with the recommendations of Regulatory Guide 1.108, position C.2.e.

9. Reliability Records

A record should be maintained in accordance with the recommendations of Regulatory Guide 1.108 position C.3.a for each diesel generator unit at a site which itemizes the demands and failures experienced by the diesel generator unit. (See also Attachment 1 to Table 4.8.2 of Appendix A).

## APPENDIX A

### TYPICAL TECHNICAL SPECIFICATIONS

#### 3/4.8 ELECTRICAL POWER SYSTEMS

##### 3/4.8.1 A.C. SOURCES

##### OPERATING

##### LIMITING CONDITION FOR OPERATION

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3.8.1.1 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

- a. Two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system, and
- b. Two separate and independent diesel generators, each with:
  1. Separate day and engine-mounted fuel tanks containing a minimum volume of \_\_\_\_ gallons of fuel,
  2. A separate fuel storage system containing a minimum volume of \_\_\_\_ gallons of fuel, and
  3. A separate fuel transfer pump.

APPLICABILITY: MODES 1, 2, 3, and 4.

##### ACTION:

- a. With an offsite circuit of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. offsite source by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter; and Surveillance Requirement 4.8.1.1.2.a.4 within 24 hours; restore at least two offsite circuits and two diesel generators to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

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NOTE: The modified Standard Technical Specification is intended as an example of changes due to the reduction in number of fast starts and diesel generator reliability improvement program surveillance requirements. Bars in the margin show changes for those portions of technical specifications associated with these two items. It is necessary for licensees to incorporate these changes into existing plant technical specification upon implementation of these two items.

ACTION: (Continued)

- b. With a diesel generator of the above required A.C. electrical power sources inoperable,\* demonstrate the OPERABILITY of the A.C. offsite sources by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter; and Surveillance Requirement 4.8.1.1.2.a.4 within 24 hours; restore diesel generators to OPERABLE status within (A\*\*) days\*\*\* or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. At the number of failures for the inoperable diesel indicated in Table 4.8-2 perform the Additional Reliability Actions prescribed in Table 4.8-2 and its attachments.
- c. With one offsite circuit and one diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. offsite source by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter and Surveillance Requirement 4.8.1.1.2.a.4 within 8 hours; restore at least one of the inoperable sources to OPERABLE status within 12 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. With the diesel generator restored to OPERABLE status, follow Action Statement a. With the offsite circuit restored to OPERABLE status, follow Action Statement b.

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\*A diesel generator shall be considered to be inoperable from the time of failure until it satisfies the requirements of Surveillance Requirement 4.8.1.1.2.4 ELECTRIC POWER SYSTEMS

\*\*The maximum time that an individual diesel generator may be inoperable (A) shall be established by the licensee based on the manufacturer's recommendations and previous maintenance and repair experience. Every reasonable effort shall be made to restore individual diesel generators to operable status within that time period (A). Every reasonable effort shall be interpreted to mean that diagnosis and repairs are to begin immediately and are to continue uninterrupted until the diesel generator is declared operable or an orderly retreat to cold shutdown is initiated.

\*\*\*The maximum total cumulative time that the diesel generators of the onsite emergency AC power system may be in the INOPERABLE status in a given year shall be proposed by the licensee.

ACTION: (Continued)

- d. With two of the above required offsite A.C. circuits inoperable, demonstrate the OPERABILITY of two diesel generators by performing Surveillance Requirement 4.8.1.1.2.a.4 within 8 hours unless the diesel generators are already operating; restore at least one of the inoperable offsite sources to OPERABLE status within 24 hours or be in at least HOT STANDBY within the next 6 hours. With only one offsite source restored, follow Action Statement a.
- e. With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite A.C. circuits by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter; restore at least one of the inoperable diesel generators to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. With one diesel generator unit restored, follow Action Statement b and d.

## 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:

- a. In accordance with the frequency specified in Table 4.8-1 on a STAGGERED TEST BASIS by:
  1. Verifying the fuel level in the day and engine-mounted fuel tank,
  2. Verifying the fuel level in the fuel storage tank,
  3. Verifying the fuel transfer pump starts and transfers fuel from the storage system to the day and engine-mounted tank,
  4. Verifying the diesel starts from ambient condition and accelerates to at least (900) rpm in less than or equal to 10 seconds.\* The generator voltage and frequency shall be  $(4160) \pm (420)$  volts and  $(60) \pm (1.2)$  Hz within (10) seconds after the start signal. The diesel generator shall be started for this test by using one of the following signals:
    - a) Manual
    - b) Simulated loss of offsite power by itself.

\*The diesel generator start (10 sec) from ambient conditions shall be performed at least once per 184 days in these surveillance tests. All other engine starts for the purpose of this surveillance testing may be preceded by an engine prelube period and/or other warmup procedures recommended by the manufacturer so that mechanical stress and wear on the diesel engine is minimized.

## SURVEILLANCE REQUIREMENTS (Continued)

- c) Simulated loss of offsite power in conjunction with an ESF actuation test signal.
  - d) An ESF actuation test signal by itself.
- 5. Verifying the generator is synchronized, loaded to greater than or equal to (continuous rating) in less than or equal to ( )-seconds,\* and operates with a load greater than or equal to (continuous rating) for at least 60 minutes,
- 6. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.
- b. At least once per 31 days and after each operation of the diesel where the period of operation was greater than or equal to 1 hour by checking for and removing accumulated water from the day and engine-mounted fuel tanks.
- c. At least once per 92 days and from new fuel oil prior to addition to the storage tanks by verifying that a sample obtained in accordance with ASTM-D270-1975 has a water and sediment content of less than or equal to .05 volume percent and a kinematic viscosity @ 40°C of greater than or equal to 1.9 but less than or equal to 4.1 when tested in accordance with ASTM-D975-77, and an impurity level of less than 2 mg. of insolubles per 100 ml. when tested in accordance with ASTM-D2274-70.
- d. 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.
  - 2. Verifying the generator capability to reject a load of greater than or equal to (largest single emergency load) kw while maintaining voltage at  $(4160) \pm (420)$  volts and frequency at  $(60) \pm (1.2)$  Hz (less than or equal to 75% of the difference between nominal speed and the overspeed trip setpoint, or 15% above nominal whichever is less).
  - 3. Verifying the generator capability to reject a load of (continuous rating) kw without tripping. The generator voltage shall not exceed (4784) volts during and following the load rejection.

\*See footnote on page 4



## SURVEILLANCE REQUIREMENTS (Continued)

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4. Simulating 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 on the auto-start signal, energizes the emergency busses with permanently connected loads within (10) seconds, energizes the auto-connected shutdown loads through the load sequencer and operates for greater than or equal to 5 minutes while its generator is loaded with the shutdown loads. After energization, the steady state voltage and frequency of the emergency busses shall be maintained at  $(4160) \pm (420)$  volts and  $(60) \pm (1.2)$  Hz during this test.
  5. Verifying that on an ESF actuation test signal, without loss of offsite power, the diesel generator starts on the auto-start signal and operates on standby for greater than or equal to 5 minutes. The generator voltage and frequency shall be  $(4160) \pm (420)$  volts and  $(60) \pm (1.2)$  Hz within (10) seconds after the auto-start signal; the steady state generator voltage and frequency shall be maintained within these limits during this test.
  6. Simulating a loss of offsite power in conjunction with an ESF actuation test signal, and
    - a) Verifying de-energization of the emergency busses and load shedding from the emergency busses.
    - b) Verifying the diesel starts on the auto-start signal, energizes the emergency busses with permanently connected loads within (10) seconds, energizes the
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## SURVEILLANCE REQUIREMENTS (Continued)

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auto-connected emergency (accident) loads through the load sequencer and operates for greater than or equal to 5 minutes while its generator is loaded with the emergency loads. After energization, the steady state voltage and frequency of the emergency busses shall be maintained at  $(4160) \pm (420)$  volts and  $(60) \pm (1.2)$  Hz during this test.

- c) Verifying that all automatic diesel generator trips, except engine overspeed and generator differential, are automatically bypassed upon loss of voltage on the emergency bus concurrent with a safety injection actuation signal.
7. 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 greater than or equal to (2-hour rating) kw and during the remaining 22 hours of this test, the diesel generator shall be loaded to greater than or equal to (continuous rating) kw. The generator voltage and frequency shall be  $(4160) \pm (420)$  and  $(60) \pm (1.2)$  Hz within (10) seconds after the start signal; the steady state generator voltage and frequency shall be maintained within these limits during this test. Within 5 minutes after completing this 24-hour test, perform Surveillance Requirement 4.8.1.1.2.d.7.b.
  8. Verifying that the auto-connected loads to each diesel generator do not exceed the 2000-hour rating of \_\_\_\_ kw.
  9. Verifying 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) Be restored to its standby status.
  10. Verifying 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 energizing the emergency loads with offsite power.
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ELECTRIC POWER SYSTEMS

Table 4.8.1

DIESEL GENERATOR TEST SCHEDULE

<u>Number of Failure in Last 20 Valid Tests*</u>	<u>Test Frequency</u>
$\leq 1$	At least once per 31 days
$\geq 2$	At least once per 7 days**

\*Criteria for determining number of failures and number of valid tests shall be in accordance with Regulatory Position C.2.e of Regulatory Guide 1.108, Revision 1, August 1977, where the number of tests and failures is determined on a per diesel generator basis. For the purposes of this test schedule, only valid tests conducted after the OL issuance date shall be included in the computation of the "last 20 valid tests."

\*\*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.

TABLE 4.8-2

ADDITIONAL RELIABILITY ACTIONS

<u>No. of failures in last 20 valid test</u>	<u>No of failures in last 100 valid tests</u>	<u>Action</u>
3	6	Within 14 days prepare and maintain a report for NRC audit describing the diesel generator reliability improvement program implemented at the site. Minimum requirements for the report are indicated in Attachment 1 to this table.
5	11	Declare the diesel generator inoperable. Perform a requalification test program for the affected diesel generator. Requalification test program requirements are indicated in Attachment 2 to this table.

ATTACHMENT 1 TO TABLE 4.8-2

REPORTING REQUIREMENT

As a minimum the Reliability Improvement Program report for NRC audit shall include:

- a) a summary of all tests (valid and invalid) that occurred within the time period over which the last 20/100 valid tests were performed
- b) analysis of failures and determination of root causes of failures
- c) evaluation of each of the recommendations of NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability in Operating Reactors," with respect to their application to the Plant
- d) identification of all actions taken or to be taken to 1) correct the root causes of failures defined in b) above and 2) achieve a general improvement of diesel generator reliability
- e) the schedule for implementation of each action from d) above
- f) an assessment of the existing reliability of electric power to engineered-safety-feature equipment

Once a licensee has prepared and maintain an initial report detailing the diesel generator reliability improvement program at his site, as defined above, the licensee need prepare only a supplemental report within 14 days after each failure during a valid demand for so long as the affected diesel generator unit continues to violate the criteria (3/20 or 6/100) for the reliability improvement program remedial action. The supplemental report need only update the failure/demand history for the affected diesel generator unit since the last report for that diesel generator. The supplemental report shall also present an analysis of the failure(s) with a root cause determination, if possible, and shall delineate any further procedural, hardware or operational changes to be incorporated into the site diesel generator improvement program and the schedule for implementation of those changes.

In addition to the above, submit a yearly data report on the diesel generator reliability.

ATTACHMENT 2 TO TABLE 4.8-2  
DIESEL GENERATOR REQUALIFICATION PROGRAM

- (1) Perform seven consecutive successful demands without a failure within 30 days of diesel generator being restored to operable status and fourteen consecutive successful demands without a failure within 75 days of diesel generator of being restored to operable status.
- (2) If a failure occurs during the first seven tests in the requalification test program, perform seven successful demands without an additional failure within 30 days of diesel generator of being restored to operable status and fourteen consecutive successful demands without a failure within 75 days of being restored to operable status.
- (3) If a failure occurs during the second seven tests (tests 8 through 14) of (1) above, perform fourteen consecutive successful demands without an additional failure within 75 days of the failure which occurred during the requalification testing.
- (4) Following the second failure during the requalification test program, be in at least HOT STANDBY within the next 6 hours and COLD SHUTDOWN within the following 30 hours.
- (5) During requalification testing the diesel generator should not be tested more frequently than at 24-hour intervals.

After a diesel generator has been successfully requalified, subsequent repeated requalification tests will not be required for that diesel generator under the following conditions:

- (a) The number of failures in the last 20 valid demands is less than 5.
- (b) The number of failures in the last 100 valid demands is less than 11.
- (c) In the event that following successful requalification of a diesel generator, the number of failures is still in excess of the remedial action criteria (a and/or b above) the following exception will be allowed until the diesel generator is no longer in violation of the remedial action criteria (a and/or b above).

Requalification testing will not be required provided that after each valid demand the number of failures in the last 20 and/or 100 valid demands has not increased. Once the diesel generator is no longer in violation of the remedial action criteria above the provisions of those criteria alone will prevail.