

ATTACHMENT 3 TO TXX-94310

AFFECTED TECHNICAL SPECIFICATION PAGES
(NUREG-1468)

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LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

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ELECTRICAL POWER SYSTEMSLIMITING CONDITION FOR OPERATION (Continued)ACTION (Continued)

offsite source restored, restore at least two offsite circuits to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

- f. With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite A.C. circuits by performing Surveillance Requirement 4.8.1.1.1a. 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. Restore at least two diesel generators to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

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) the 6.9 kV safeguards bus power supply from the preferred offsite source to the alternate offsite source.

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:

- a. ~~In accordance with the frequency specified in Table 4.8.1^g on a~~ ^{At least once per 31 days} 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 starts and transfers fuel from the storage system to the day fuel tank,
 - 4) Verifying the diesel starts from ambient condition and accelerates to at least 441 rpm in less than or equal to 10 seconds.*#

*All planned diesel engine starts for the purpose of this surveillance may be preceded by a prelube period in accordance with vendor recommendations.

#The diesel generator start time (10 seconds) shall be verified at least once per 184 days. All other engine starts for performance of this surveillance, may use a diesel generator start involving gradual acceleration to synchronous speed as recommended by the manufacturer.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

- a) Barring device engaged, or
- b) Maintenance Lockout Mode.
- g. 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 441 rpm (58.8 Hz) in less than or equal to 10 seconds; and
- h. At least once per 10 years by:
 - 1) Pumping out each fuel oil storage tank, removing the accumulated sediment and cleaning the tank using a sodium hypochlorite solution or equivalent, and
 - 2) Performing a pressure test of those portions of the diesel fuel oil system designed to Section III, subsection ND of the ASME Code, when tested pursuant to Specification 4.0.5.

~~4.8.1.1.3 Reports - All diesel generator failures, valid or non-valid, shall be reported to the Commission in a Special Report pursuant to Specification 6.9.2a within 20 days. Reports of diesel generator failures shall include the information recommended in Regulatory Position C.3.b of Regulatory Guide 1.108, Revision 1, August 1977. If the number of failures in the last 100 valid tests on a per diesel generator basis is greater than or equal to 7, the report shall be supplemented to include the additional information recommended in Regulatory Position C.3.b of Regulatory Guide 1.108, Revision 1, August 1977.~~

*All planned diesel engine starts for the purpose of this surveillance may be preceded by a prelube period in accordance with vendor recommendations.

~~TABLE 4.8-1~~
~~NOT USED~~
~~DIESEL GENERATOR TEST SCHEDULE~~

NUMBER OF FAILURES IN LAST 20 VALID TESTS**	NUMBER OF FAILURES IN LAST 100 VALID TESTS**	TEST FREQUENCY*
≤ 1	≤ 4	Once per 31 days
$\geq 2^{**}$	≥ 5	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, but determined on a per diesel generator basis.~~

~~For the purpose of determining the required test frequency, the previous test failure count may be reduced to zero if a complete diesel overhaul to like new condition is completed, provided that the overhaul, including appropriate post-maintenance operation and testing, is specifically approved by the manufacturer and if acceptable reliability has been demonstrated. The reliability criterion shall be the successful completion of 14 consecutive tests in a single series. These tests shall be in accordance with the routine Surveillance Requirements 4.8.1.1.2a.4) and 4.8.1.1.2a.5). If this criterion is not satisfied during the first series of tests, any alternate criterion to be used to transvalue the failure count to zero requires NRC approval.~~

~~**The associated 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.~~

ELECTRICAL POWER SYSTEMS

A.C. SOURCES

SHUTDOWN

LIMITING CONDITION FOR OPERATION

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

- a. One circuit between the offsite transmission network and the Onsite Class 1E Distribution System, and
- b. One diesel generator with:
 - 1) Day fuel tank containing a minimum volume of 1440 gallons of fuel,
 - 2) A fuel storage system containing a minimum volume of 86,000 gallons of fuel, and
 - 3) A fuel transfer pump.

APPLICABILITY: MODES 5 and 6.

ACTION:

With less than the above minimum required A.C. electrical power sources OPERABLE, immediately suspend all operations involving CORE ALTERATIONS, positive reactivity changes, movement of irradiated fuel, or crane operation with loads over the fuel storage pool, and within 8 hours, depressurize and vent the Reactor Coolant System through a greater than or equal to 2.98 square inch vent. In addition, when in MODE 5 with the reactor coolant loops not filled, or in MODE 6 with the water level less than 23 feet above the reactor vessel flange, immediately initiate corrective action to restore the required sources to OPERABLE status as soon as possible.

SURVEILLANCE REQUIREMENTS

4.8.1.2 The above required A.C. electrical power sources shall be demonstrated OPERABLE by the performance of each of the requirements of Specifications 4.8.1.1.1, 4.8.1.1.2 (except for Specification 4.8.1.1.2a.5)) ~~and 4.8.1.1.3.~~

and

ELECTRICAL POWER SYSTEMS

BASES

A.C. SOURCES, D.C. SOURCES, and ONSITE POWER DISTRIBUTION (Continued)

The Fuel Storage System consists of the fuel oil storage tank and is equivalent to the ANSI N195-1976 definition for supply tank.

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; 1.108, "Periodic Testing Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977; and 1.137, "Fuel-Oil Systems for Standby Diesel Generators," January 1978, Generic Letter 84-15, and Generic Letter 83-26, "Clarification of Surveillance Requirements for Diesel Fuel Impurity Level Tests," and Generic Letter 94-01, "Removal of Accelerated Testing and Special Reporting Requirements For Emergency Diesel Generators." ~~The Diesel Generator Test schedule, Table 4.8-1, is based on the recommendations of Regulatory Guide 1.108, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977, and NRC Technical Report A-3230, "Evaluation of Diesel Unavailability and Risk Effective Surveillance Test Intervals," May 1986, and Generic Letter 84-15, "Proposed Staff Position to Improve and Maintain Diesel Generator Reliability."~~

The Surveillance Requirement for demonstrating the OPERABILITY of the station batteries are based on the recommendations of Regulatory Guide 1.129, "Maintenance Testing and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," Revision 1, February 1978, Regulatory Guide 1.32, "Criteria for Safety Related Electric Power Systems for Nuclear Power Plants," Revision 2, February 1977, and IEEE STD 450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."

The operational requirement to energize the instrument busses from their associated inverters connected to its associated D.C. bus is satisfied only when the inverter's output is from the regulated portion of the inverter and not from the unregulated bypass source via the internal static switch.

Verifying average electrolyte temperature above the minimum for which the battery was sized, total battery terminal voltage on float charge, connection resistance values, and the performance of battery service and discharge tests ensures the effectiveness of the charging system, the ability to handle high discharge rates, and compares the battery capacity at that time with the rated capacity.

Table 4.8-2 specifies the normal limits for each designated pilot cell and each connected cell for electrolyte level, float voltage, and specific gravity. The limits for the designated pilot cells float voltage and specific gravity, greater than 2.13 volts and 0.015 below the manufacturer's full charge specific gravity or a battery charger current that had stabilized at a low value, is characteristic of a charged cell with adequate capacity. The normal limits for each connected cell for float voltage and specific gravity, greater than 2.13 volts and not more than 0.020 below the manufacturer's full charge specific gravity with an average specific gravity of all the connected cells not more than 0.010 below the manufacturer's full charge specific gravity, ensures the OPERABILITY and capability of the battery.

ENCLOSURE 1 TO TXX-94310

GENERIC LETTER 94-01, "REMOVAL OF ACCELERATED
TESTING AND SPECIAL REPORTING REQUIREMENTS FOR
EMERGENCY DIESEL GENERATORS", MAY 31, 1994



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

May 31, 1994

RECEIVED
MAY 31 1994
J. CAHILL

TO: ALL HOLDERS OF OPERATING LICENSES FOR NUCLEAR POWER REACTORS

SUBJECT: REMOVAL OF ACCELERATED TESTING AND SPECIAL REPORTING REQUIREMENTS
FOR EMERGENCY DIESEL GENERATORS (GENERIC LETTER 94-01)

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter to advise licensees that they may request a license amendment to remove accelerated testing and special reporting requirements for emergency diesel generators (EDGs) from plant technical specifications (TS). The NRC developed this line-item TS improvement in response to the Commission decision on SECY-93-044, "Resolution of Generic Safety Issue B-56, 'Diesel Generator Reliability'." Enclosure 1 is the guidance on preparing the amendment request and Enclosure 2 is the model TS for this change.

In Option 4 of SECY-93-044, the staff recommended that licensees adopt the accelerated testing provisions of the improved Standard Technical Specifications with an option to relocate accelerated testing requirements for EDGs from the TS to the maintenance program after the maintenance rule goes into effect. However, after further consideration, the staff has concluded that it is not necessary to await the effective date of the maintenance rule to remove the associated TS requirements nor is it necessary to relocate accelerated testing requirements to the maintenance program. Licensees may now implement the provisions of the maintenance rule for EDGs, including the applicable regulatory guidance which will provide a program to assure EDG performance. Therefore, the requirements for accelerated testing of individual EDGs would no longer exist.

Licensees may request the removal of the TS provisions for accelerated testing and special reporting requirements for EDGs at this time. However, when requesting this license amendment, licensees must commit to implement within 90 days of the issuance of the license amendment a maintenance program for monitoring and maintaining EDG performance consistent with the provisions of Section 50.65 of Title 10 of the Code of Federal Regulations (10 CFR 50.65), "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and the guidance (as applicable to EDGs) of Regulatory Guide (RG) 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The NRC staff developed RG 1.160 to provide guidance for complying with the provisions of 10 CFR 50.65.

Some licensees do not have TS requirements for accelerated testing of EDGs and reporting each EDG failure to the NRC, but may have made a docketed commitment to such actions. In such cases, licensees may request relief from a docketed commitment for accelerated testing and special reporting requirements for

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May 31, 1994

EDGs. Such requests should be made on the basis of implementation of the provisions of the maintenance rule and associated regulatory guidance (as applicable to EDGs) within 90 days of NRC granting relief from a docketed commitment.

Licensees that plan to adopt this line-item TS improvement are encouraged to propose TS changes that are consistent with the enclosed guidance in Enclosures 1 and 2. Licensees that plan to request relief from a docketed commitment to accelerated testing of EDGs and special reporting of EDG failures are encouraged to propose such requests consistent with the guidance in Enclosure 1.

Licensee action to propose TS changes or relief from a docketed commitment under the guidance of this generic letter is voluntary. Therefore, such action is not a backfit under the provisions of 10 CFR 50.109. As such, the staff did not perform a backfit analysis.

The voluntary information collections contained in this request are covered by the Office of Management and Budget clearance number 3150-0011, which expires June 30, 1994. The public reporting burden for this voluntary collection of information is estimated to average 40 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this voluntary collection of information, including suggestions for reducing this burden, to the Information and Records Management Branch (MNBB-7714), U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and to the Desk Officer, Office of Information and Regulatory Affairs, NE08-3019, (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

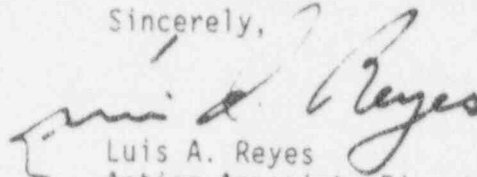
Compliance with the following request for information is voluntary. The information would assist NRC in evaluating the cost of complying with this generic letter:

- (1) the licensee staff time and costs to prepare the amendment request
- (2) an estimate of the long-term costs or savings accruing from this TS change

May 31, 1994

If you have any questions about this matter, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

Sincerely,



Luis A. Reyes
Acting Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosures:

1. Guidance on Preparing the Amendment Request
2. Model TS for Change
3. List of Recently Issued NRC Generic Letters

Technical contacts: Om Chopra, NRR
(301) 504-3265

Tom Dunning, NRR
(301) 504-1189

GUIDANCE FOR IMPLEMENTING A LINE-ITEM TECHNICAL SPECIFICATION (TS)
IMPROVEMENT TO REMOVE ACCELERATED TESTING AND SPECIAL REPORTING
REQUIREMENTS FOR EMERGENCY DIESEL GENERATORS (EDGs)
FROM PLANT TECHNICAL SPECIFICATIONS OR
FROM DOCKETED COMMITMENTS

Background

As part of the resolution of Generic Safety Issue (GSI) B-56, "Diesel Generator Reliability," the staff of the U.S. Nuclear Regulatory Commission (NRC) recommended Option 4 in SECY-93-044, "Resolution of Generic Safety Issue B-56, 'Diesel Generator Reliability'." The Commission approved Option 4 on March 25, 1993. In Option 4, the NRC staff recommended (in part) that licensees be allowed to voluntarily adopt the accelerated testing provisions of the improved Standard Technical Specifications; and upon a determination that the maintenance program conforms to the applicable guidance, the accelerated testing requirements for the EDGs could be relocated from the TS to the maintenance program when the maintenance rule goes into effect in 1996. However, after further consideration, the staff has concluded that it is not necessary to await the effective date of the maintenance rule to remove the associated TS requirements nor is it necessary to relocate accelerated testing requirements to the maintenance program. Licensees may now implement the provisions of the maintenance rule for EDGs, including the applicable regulatory guidance, which will provide a program to assure EDG performance. The elements of this program will include the performance of a detailed root cause analysis of individual EDG failures, effective corrective actions taken in response to individual EDG failures, and implementation of EDG preventive maintenance consistent with the maintenance rule.

The staff has concluded that licensees may also propose TS changes to remove special reporting requirements for EDGs from their plant TS. Licensees may also request relief from a docketed commitment for accelerated testing of EDGs and reporting each EDG failure to the NRC. Licensees would continue to comply with the provisions of 10 CFR 50.72 and 50.73 to notify NRC and report EDG failures. With this TS change or NRC relief from a docketed commitment to such actions, requirements for accelerated testing of EDGs would no longer exist.

The staff approval of this option would be contingent upon a commitment to implement, within 90 days of a license amendment, or NRC granting relief from a docketed commitment, a maintenance program for monitoring and maintaining EDG performance in accordance with the provisions of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and the guidance contained in Regulatory Guide (RG) 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The fulfillment of this commitment need not necessarily result in a new or separate EDG maintenance program but rather could be implemented by modification of existing maintenance program requirements that include EDGs.

Discussion

The NRC staff developed RG 1.160 to provide flexibility for licensees to structure their maintenance program based on the risk significance of the structures, systems, and components that are within the scope of the maintenance rule. This guide endorses a Nuclear Utility Management and Resources Council (NUMARC) guideline¹ which gives methods acceptable to the NRC staff for complying with the provisions of the maintenance rule (10 CFR 50.65).

During the public comment period for this generic letter, the staff met with the Advisory Committee for Reactor Safeguards (ACRS). As a consequence of continuing ACRS concerns on the use of trigger values, included in a NUMARC guideline,² the NRC staff will modify RG 1.160 by removing the language on the use of trigger values for monitoring EDG performance. However, the staff intends to retain in RG 1.160 the discussion on NRC's expectations that licensees would (1) establish performance criteria for both emergency diesel generator reliability and unavailability, under paragraph (a)(2) of the maintenance rule, (2) perform appropriate root cause determination and corrective action following a single maintenance-preventable failure, and (3) establish goals and monitor subsequent EDG performance under paragraph (a)(1) of the maintenance rule if any performance criterion is not met or a second EDG maintenance-preventable failure occurs.

In addition to the focus on paragraphs (a)(1) and (2) of the maintenance rule as addressed in the NRC's expectations on implementing the guidance of RG 1.160, paragraph (a)(3) of the maintenance rule must also be met and requires (in part) that licensees make adjustments where necessary to ensure that the objective of preventing failures through maintenance is appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance.

Therefore, a commitment to implement the maintenance rule consistent with the guidance of RG 1.160 as applicable for EDGs is a commitment to (1) implement the endorsed NUMARC guideline, 93-01, with the exception of the reference to NUMARC 87-00 on the use of trigger values and (2) fulfill the NRC staff expectations discussed in RG 1.160. Should licensees wish to propose an alternative to implementing the guidance of RG 1.160, to demonstrate compliance with the maintenance rule for EDGs, the NRC staff will consider such proposals.

The NRC staff finds that a commitment to implement a maintenance program for monitoring and maintaining EDG performance in accordance with the provisions of the maintenance rule and consistent with the guidance of RG 1.160 would provide a basis for the staff to approve a licensee request to remove the

¹NUMARC 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," May 1993.

²Appendix D of NUMARC 87-00, Revision 1, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at LWRs," August 1991.

accelerated testing and special reporting requirements for EDGs from their plant TS. This commitment would also provide the basis for the staff to approve requests for relief from a docketed commitment to accelerated testing of EDGs and reporting each EDG failure. Licensees must commit to implementing within 90 days of the issuance of the license amendment or commitment relief the provisions of 10 CFR 50.65 and guidance of RG 1.160 for EDGs when requesting the removal of the EDG accelerated testing and special reporting requirements from their plant TS or docketed commitment. The elimination of accelerated testing requirements for EDGs closes the matter of triggers and testing for "problem diesels."

Enclosure 2 includes model EDG technical specifications which address these TS changes.

MODEL STANDARD TECHNICAL SPECIFICATIONS FOR REMOVING ACCELERATED TESTING
AND SPECIAL REPORTING REQUIREMENTS FOR EDGs

Revisions to TS 4.8.1.1.2 (Changes are shown in bold typeface.)

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:

a. At least once per 31 days on a STAGGERED TEST BASIS by:

1) through 7) no change.

(Removes the reference to TS Table 4.8.1.1.2-1 for the test schedule.)

Revisions to Table 4.8.1.1.2-1 (Changes are shown in bold typeface.)

TABLE 4.8.1.1.2-1
DIESEL GENERATOR TEST SCHEDULE

(Not used)

(Removes accelerated testing requirements for EDG's which were based on the number of failures in the last 20 and 100 valid tests.)

Revisions to TS 4.8.1.1.3, "Reports" (Changes are shown in bold typeface.)

4.8.1.1.3 Reports (Not used)

(10 CFR 50.72 and 50.73 address the remaining regulatory requirements for licensees to notify NRC and report individual EDG failures.)

ENCLOSURE 2 TO TXX-94310

SAFETY EVALUATIONS, INSPECTION REQUIREMENTS
FOR TDI, DIESEL GENERATORS (TAC NO. M85325)

MARCH 17, 1994

PAGES 1, 2, SER 1, 6, 7, 9, 10 AND 11

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20540

RECEIVED
MAR 21 1994

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MAR 1994

Mr. J. C. Day
Duke Engineering & Services, Inc.
Duke Diesel Generators Owners' Group
Clearinghouse
1000 14th Street, NW
Box 1004
Charlotte, North Carolina 28201-1004

Activity	Activity
Owners	4
CD	4
REG	4
TRANS	4
FR	4

Dear Mr. Day:

SUBJECT: SAFETY EVALUATION, INSPECTION REQUIREMENTS FOR TRANSAMERICA DELAVAL, INC. DIESEL GENERATORS (TAC NO. M85325)

The Transamerica Delaval (TDI) diesel generators Owners' Group (Owners' Group) submitted proposals on November 30, 1992 (Reference 1 in the enclosed Safety Evaluation) and December 7, 1993 (Reference 2), recommending removal of licensing conditions imposed as part of a technical resolution to address concerns regarding the reliability of the TDI emergency diesel generators (EDGs) following the crankshaft failure at Shoreham in August 1983. The technical resolution involved implementation of Phase I and Phase II programs as identified in NUREG-1216 (Reference 3). The Phase I program focused on the resolution of known engine component problems that had potential generic implications, while the Phase II program focused on the design review of a large set of important engine components to ensure their adequacy from a manufacturing standpoint, as well as operational performance. At that time, the staff concluded that these components merited special emphasis in the area of load restrictions and/or maintenance and surveillance. The 16 major components which were identified included connecting rods, crankshafts, cylinder blocks, cylinder heads, piston skirts, and turbochargers. Engine load restrictions were addressed in the plant Technical Specifications, license conditions, engine operating procedures and operator training, as appropriate, for five of these components. The most critical periodic maintenance/surveillance actions for these components were incorporated as license conditions.

On the basis of substantial operational data and inspection results the Owners' Group provided information in References 2 and 3 to demonstrate that the special concerns of NUREG-1216 are no longer warranted. The Owners' Group stated that the TDI EDGs should be treated on a par with other EDGs within the nuclear industry and subjected to the same standard regulations, without the special requirements of NUREG-1216. In addition, the Owners' Group stated that this action will improve availability of the engines for service, especially during outages, while maintaining current reliability levels.

The NRC staff and its consultants at Pacific Northwest Laboratories (PNL) have completed a review of the operational data and inspection results contained in the Owners' Group submittal reports relative to the individual components. In addition, independent opinions were obtained from three leading diesel engine experts regarding these inspection requirements.

On the basis of its review, the staff has concluded that there is adequate justification for removing the present component-based licensing conditions. The staff's evaluation of the Owners' Group's submittal reports is in the attached safety evaluation (SE).

It is intended that the attached SE be referenced by affected licensees in proposals for changes to facility licenses to the extent specified and under the limitations delineated in the licensee submittals and the associated NRC evaluation. The evaluation defines the basis for the approval of the reports and is applicable to the eight Owners' Group licensees: Texas Utilities for Comanche Peak; Entergy Operations for Grand Gulf; Duke Power for Catawba; Carolina Power for Shearon Harris; Georgia Power for Vogtle; Cleveland Electric Illuminating for Perry; Grand Gulf Utilities for River Bend; and Tennessee Valley Authority for Bellefonte.

In accordance with procedures established in NUREG-0390, the TDI Owners' Group is requested to publish approved versions of the Owners Group reports as generic topical reports within three months of receipt of this staff approval. The accepted version should incorporate this approval letter and the enclosed evaluation between the title page and the abstract. The approved version shall include an -A (designating approved) following the report identification symbol.

The staff does not intend to repeat its review of the approved matters described in the approved generic topical reports when the reports appear as references in license applications except to assure that the material presented is applicable to the specific plant involved. The staff's approval applies only to the matters described in the reports.

Should the staff's criteria or regulations change so that the staff's conclusions as to the acceptability of the reports are invalidated, the Owners' Group and/or the licensees referencing the reports will be expected to revise and resubmit their respective documentation, or submit justification for the continued effective applicability of the reports without revisions of their respective documentation.

Sincerely,



James A. Norberg, Chief
Mechanical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELIABILITY AND REQUALIFICATION REVIEW OF EMERGENCY DIESEL GENERATORS
MANUFACTURED BY TRANSAMERICA DELAVAL, INC.

INTRODUCTION

During the 1970s, many utilities ordered diesel generators from Transamerica Delaval, Inc. (TDI) for installation at nuclear plants in the United States. The first of these engines to become operational in nuclear service were those at San Onofre Unit 1 in 1977. However, nuclear plant operating experience with TDI emergency diesel generators (EDGs) remained very limited until preoperational test programs were started at Shoreham and Grand Gulf Unit 1 in the early 1980s.

Concerns about the reliability of large-bore, medium-speed diesel generators manufactured by TDI for application at domestic nuclear plants were first prompted by a crankshaft failure at Shoreham in August 1983. However, a broad pattern of deficiencies in critical engine components subsequently became evident at Shoreham and at other nuclear and non-nuclear facilities employing TDI diesel generators. These deficiencies stemmed from inadequacies in design, manufacture, and quality assurance/quality control by TDI.

In response to these problems, 11 (now 8) U.S. nuclear utility owners¹ formed a TDI Diesel Generator Owners' Group to address operational and regulatory issues relative to diesel generator sets used for standby emergency power. On March 2, 1984, the Owners' Group submitted a proposed program ("TDI Owners' Group Program Plan") to the NRC that was intended to provide an in-depth assessment of the adequacy of the respective utilities' TDI engines to perform their safety-related function through a combination of design reviews, quality revalidations, engine tests, and component inspections.

The Owners' Group program addressed three major elements concerning the manufacture, inspection, and operation of TDI diesel engines:

- (1) Phase I: Resolution of known generic engine component problems to serve as a basis for licensing plants during the period before completion of Phase II of the Owners' Group program.
- (2) Phase II: A Design Review/Quality Revalidation (DR/QR), of a large set of important engine components to ensure that their design and manufacture, including specifications, quality control and quality assurance, and operational surveillance and maintenance, are adequate.
- (3) Expanded engine tests and inspections as needed to support Phase I and II programs.

¹ Carolina Power and Light Co. (Shearon Harris), Cleveland Electric Illuminating Co. (Perry), Duke Power Co. (Catawba), Georgia Power Co. (Vogtle), Gulf States Utilities (River Bend), Entergy Operations, Inc. (Grand Gulf Units 1 & 2), N.A. (Bellefonte), Texas Utilities (Comanche Peak).

proposes to use this generic diesel management program in lieu of the current maintenance/surveillance requirements.

In the basis of the substantial operational experience of the TDI EDGs accumulated since 1985 and the inspection results of the EDG components, the Owners' Group has provided information in its submittal reports of November 10, 1992, and December 7, 1993 (References 2 and 3) to demonstrate that the special concerns of NUREG-1216 are no longer warranted. The Owners' Group has recommended removing the license conditions related to EDG component inspections involving teardowns and surveillance requirements.

The Owners' Group has analyzed the need for engine overhauls in accordance with the current OR/QR requirements. Their analysis and conclusions are based on an understanding of the historical concerns for each component affected by the overhaul and the results of extensive inspections performed by the licensees who make up the TDI Owners' Group. The information in its submittal reports includes component description, component identification number per the OR/QR Appendix I, 'Preventive Maintenance (PM) Task Description,' the manufacturer's replacement/overhaul recommendations, the number of engine hours run between inspections or cumulative engine hours, number of engine starts, inspection findings, and the percentage of all components in service covered by the inspections. The results of the inspections compiled by the Owners' Group in its submittal reports (References 2 and 3) indicate that most teardowns have shown little or no wear on internal engine components. However, with continuing operation, it is possible that problems could occur with specific components which could require inspection or overhaul of affected components. The Owners' Group is proposing that such actions be determined on a case-by-case basis, and that inspections or overhauls be performed so that engine reliability and availability are maximized. The Owners' Group contends that the primary purpose of EDG 10-year teardown inspections is to document the condition of the specific components, not to replace components, since most components being inspected show little or no wear. However, as a matter of good maintenance practice, these components are generally replaced after a teardown inspection, regardless of condition. These teardowns can result in reassembly errors or entry of foreign materials resulting in increased wear or decreased engine reliability.

The Owners' Group believes that an overhaul will be needed during the life of these engines as they are currently operated. However, due to the limited number of run hours and the availability of periods to perform major teardowns the licensees need the flexibility to determine when an overhaul is required and how an overhaul is conducted.

The Owners' Group contends that some of the early concerns with EDG components were caused by the deleterious effects of the fast starts and loading of EDGs in nuclear service. The Owners' Group notes that the life expectancy of most engine components in commercial service, which are not subject to fast starts, is far greater than the estimated life of EDG components in nuclear service based on early data.

All licensees have the authority to delete fast-start and loading requirements on the basis of Generic Letter (GL) 84-15, and are committed to doing so.

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However, some licensees have not taken this step for a number of reasons. First, many engines have control systems which will not allow a slow start. The necessary changes in such control systems are currently being implemented. Second, some of the TDI licensees want to consolidate all changes for a particular technical specification (TS) to lessen the impact on the licensee and the NRC workload resulting from a TS change request. The staff is currently preparing a GL addressing the requirements for accelerated testing of emergency diesels. Most licensees are waiting for this GL to be issued before requesting a change to their TSs which would include a request for the deletion of the fast starts. Once the slow start option is implemented and accelerated testing is eliminated, engines at nuclear plants will be operated similarly to those in commercial service, and the expected life of components in engines at nuclear plants should compare favorably with commercial engine components. The data from engines in nuclear service which have implemented the slow-start option supports this contention. Since the manufacturer's recommendations for commercial operation of TDI/EDG components prior to overhaul indicate that there are substantial safety margins available, appropriate changes can be made in M/S requirements based on realistic estimates of component life expectancy, and flexibility can be achieved in the frequency of performing teardown inspections.

The Owners' Group, in its submittal reports, has also discussed the need for flexibility in scheduling teardown inspections from the standpoint of shutdown risk management (SRM). According to the Owners' Group, the "available windows" of outage time of sufficient length to allow engine teardowns and/or overhauls are being shortened because of SRM requirements. The "available window" during which a diesel can be removed from service for maintenance depends on a number of factors, including plant design, availability of alternate power sources, fuel handling schemes, and other operational, maintenance, or inspection requirements. These factors cause the "available window" to vary from outage to outage. Typically, the "available window" is between 10 and 21 days; however, SRM programs have compressed this "window" by as much as 20%. As a result of this shortening of "available windows," all plants need maximum flexibility in scheduling EDG maintenance activities (i.e., schedule major diesel work during times when longer "windows" are available without impacting overall outage length). Time-directed teardowns/overhauls do not allow this flexibility. The Owners' Group is proposing a generic diesel management program which combines predictive maintenance, surveillance, and inspection. The Owners' Group contends that with this program, considerable flexibility can be achieved in the frequency of performing teardowns and/or overhauls without sacrificing engine reliability.

Typical components that are inspected or replaced or both during an engine overhaul are turbochargers, main bearing caps/studs, cylinder blocks, connecting rods/bearings/bushings, cylinder heads, push rods, lower cylinder liner seals, base assemblies, crank shafts, cylinder liners, pistons/rings, fuel injection tubing, and rocker arm capscrews/drive studs. Problems with these components resulting from the intrusive inspections could certainly limit or preclude the engine's acceptable power output. Disassembly of these components can result in the accidental introduction of dirt and other foreign materials that may harm the engine. In addition, these components are

- Because specific surveillances/inspections were imposed by regulation to ensure that acceptable engine conditions were being maintained, the inspection results should not identify unacceptable findings.
- The Owners' Group should have an alternative diesel management program with elements that are judged by the regulatory staff to be reasonably and actually effective compared to current license requirements in maintaining diesel reliability.
- The underlying source or technical basis for the proposed regulatory change should be justified by authorities and expertise equal to that which determined the current regulatory requirements.

As discussed in the following paragraphs, all five criteria have been satisfied. The current TDI engine reliability was found to be equal to or better than the industry average. In the period between January 1990 and December 1992, the median reliability of TDI diesels was found to be 0.9906. This is about 1% better than the nuclear industry average, and well above NRC's highest goal of 0.975.

Specific surveillances/inspections were imposed by NRC regulations to ensure that acceptable TDI engine conditions were being maintained. A review of the operational database and the inspection results for the key components, as discussed in Appendix A, show no unacceptable findings. In fact, most inspections did not uncover any signs of wear or degradation that need to be addressed.

NRC-sponsored research (Reference 8) has indicated the potentially negative consequences of intrusive inspections on components and engine reliability as a result of current practices. In a study of failures related to aging, a failure curve, sometimes called the "bathtub" curve, correlates the change in failure rate with age. The beginning segment of the curve represents a "wear-in" portion, with a higher failure rate associated with many pieces of new equipment. Once the machinery is broken in, the failure rate is at its lowest and remains constant for a period of time. As the machinery wears and reaches the end of its lifetime, the failure rate increases. The challenge is to determine the time scale for these regions for each piece of equipment. On the basis of these studies, it is generally believed that the diesel engine's reliability is considerably lower during the "wear-in" period, and some engines may be on the lower end of the acceptable range of reliability, during the "wear-in" period of operation.

Some of the early concerns with EDG components were due to the deleterious effects of fast start and loading of EDGs in nuclear service. Component life expectancy in commercial TDI engines which are not subject to fast starts is far greater than life expectancy for TDI engine components in nuclear service. Although the fast-start requirements have been relaxed on the basis of GL 84-15, not all licensees have implemented the changes in the EDG control system to permit slow starts. All members of the Owners' Group are committed to implementing these changes in the near future. The staff is also addressing the issues related to accelerated testing in a generic letter to be issued shortly. Once the slow start option has been implemented and accelerated

testing has been eliminated, nuclear service engine operation will more closely match that of engines in commercial service and the expected component life for TOI engines in nuclear service should compare favorably with commercial engine component life. The data from engines in nuclear service which have tolerated the slow-start option supports this contention. A review of the manufacturer's recommendations for commercial operation of TOI EDG components before overhaul indicates that there are substantial safety margins available for most components in nuclear service. The staff concurs with the Owners' Group recommendation that by combining predictive maintenance, surveillance, and inspections, as in the proposed generic diesel management program, considerable flexibility can be achieved in the frequency of performing engine teardowns and/or overhauls without sacrificing engine reliability.

The Owners' Group contends that the "available windows" of outage time of sufficient length to allow engine teardowns and/or overhauls are being shortened due to SRM requirements. As a result of this shortening of available windows, all plants need maximum flexibility in scheduling EDG maintenance activities. The adoption of a predictive maintenance program for EDGs as proposed, in lieu of the current time-directed teardown/overhaul requirements would give the licensee this flexibility without jeopardizing engine reliability.

The Owners' Group has requested the removal of inspection requirements from the license conditions. The Owners' Group proposes to continue appropriate inspections; however, scope, inspection schedules, and especially the amount of intrusive inspections involving disassembly would be changed to maximize EDG availability and reliability. Inspections would be planned to respond to monitoring and trending results and where other maintenance activities make the component accessible, such as in response to failures of nearby components or where monitoring is indicating an end of component life conditions. The Owners' Group will continue appropriate inspections, especially those not involving engine disassembly. Inspections will be defined and included as part of a well-managed engine program currently under preparation. Elements of correct engine management have been reported previously to the NRC and industry (References 8 and 9). Key features of an EDG management program, acceptable to the staff (see Appendix C of this safety evaluation) have been discussed and provided to the Owners' Group. The Owners' Group agrees that each member would adopt the group's proposed generic management program, resolution, or mitigating actions, and that all actions are intended to be acceptable to the manufacturer.

Finally, the underlying source or technical basis for the proposed regulatory change is equal in expertise to that which was responsible for recommending the current regulatory requirements. The TOI Owners' Group, with support from the manufacturer, was instrumental in preparing the technical basis for the original regulatory conditions in NUREG-1216.

7. OVERALL CONCLUSIONS

The staff, with assistance from its consultants and recognized diesel engine experts, concluded that the regulatory requirements on TOI engines may be

reconsidered at this time. This conclusion is based on a review of the current reliability data of the TDI engines, the Owners' Group inspections of the last several years, and the opinion of experts who have experience in the design and operation of large diesel engines. The staff believes that the TDI Owners' Group, like any other owners group, must address the unique maintenance needs for its specific engine to keep the reliability factor acceptable. With a current median reliability of 0.3906, the TDI Owners' Group, and its individual owners, seem to fully understand the maintenance needs of this engine. The staff further believes that there is sufficient information in the Owners' Group submittal reports to conclude that TDI engine operation at authorized loads is acceptable under normal NRC regulatory oversight procedures for EDGs. The staff and its consultants, in their review of the TDI submittal reports and the operational database, did not uncover any new concerns or issues. Individual reports from recognized experts endorse many of the TDI engine management practices, inspections, or precautions. The Owners' Group intends to incorporate most of the inspections and precautions from the current M/S requirements in its generic diesel management program and appropriately supplement these inspections with alternate condition monitoring procedures. All members of the Owners' Group are committed to implement this diesel management program.

The key features of a maintenance program which the staff finds acceptable are delineated in Appendix C of this safety evaluation. The staff has reviewed the preliminary version of the diesel management program, which the Owners' Group is proposing in lieu of the current M/S requirements. The staff finds the principal elements of this program acceptable. The proposed maintenance program is in conformance with the requirements in Regulatory Guide 1.160, 'Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,' dated June 1993, which endorses NUREG 93-01 dated May 1993, 'Industry Guide for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.'

Accordingly, the staff has concluded that the license conditions related to the periodic M/S program (see Appendix D of this safety evaluation) for certain components (see Appendix E of this safety evaluation) which were imposed on the licensees based on the recommendations in NUREG-1216, be removed at this time. Therefore, the detailed steps of the preventive M/S programs will not be subject to NRC staff review and approval. However, the staff believes that future revisions of the M/S program would be subject to the provisions of 10 CFR 50.59 (Code of Federal Regulations) in view of the importance of the M/S program in ensuring the operability and reliability of the engines. The staff will require that the owners of each plant commit to the current M/S program in the interim period preceding the implementation of the generic diesel management program currently under development in association and agreement with the manufacturer. The transition from the current M/S program to the generic diesel management program could be accomplished under the provisions of 10 CFR 50.59. The TS requirements of subjecting the diesel to an inspection in accordance with procedures prepared in conjunction with its manufacturer's recommendations for the class of standby service would continue to remain in effect, similar to the TS requirements on other EDG manufacturers.