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REGULATORY GUIDE

REGULATORY GUIDE 1.137

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FUEL OIL SYSTEMS FOR EMERGENCY POWER SUPPLIES

A. INTRODUCTION

Purpose

This regulatory guide (RG) describes updated methods that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for use in complying with the NRC requirements regarding fuel oil systems for safety-related diesel powered generators and diesel oil-fueled gas turbine generators, including assurance of adequate fuel oil quality. The guidance provided herein may also be applied to the fuel oil systems for nonsafety-related standby power supplies to the extent deemed appropriate to the safety significance of the power supplies.

Applicable Rules and Regulations

The regulatory framework the NRC has established for nuclear power plants consists of a number of regulations and supporting guidelines applicable to the diesel and diesel-fueled gas turbine generators and their components in the onsite electric power system. Title 10, of the *Code of Federal Regulations*, Part 50, "Domestic Licensing of Production and Utilization Facilities" (10 CFR Part 50) (Ref. 1), Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criteria (GDC) 17, "Electric Power Systems," requires, in part, that an onsite electric power system be provided to permit functioning of structures, systems, and components (SSCs) important to safety. GDC-17 also requires that the onsite electric power supplies shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. The onsite electrical power system includes standby power sources, distribution systems, and vital auxiliary supporting systems to supply power to SSCs important to safety. When a commercial nuclear power plant uses diesel fueled generators as part of their standby power source for the onsite electric power system, the diesel fueled generators and related components, including the fuel oil, are classified as safety-related equipment. The safety-related diesel fueled generators in the onsite electric power system are required to provide electric power to safety-related SSCs in the event of a postulated accident and, as such, are commonly referred to as emergency diesel generators (EDGs).

In accordance with GDC-1, "Quality Standards and Records," safety-related equipment must have established quality standards to provide adequate assurance that SSCs important to safety will satisfactorily perform their safety functions. Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 describes criteria that must be met by a quality assurance program for SSCs that prevent or mitigate the consequences of postulated accidents. The

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Electronic copies of this regulatory guide and previous version of this guide and other recently issued guides are available through the NRC's public Web site under the Regulatory Guides document collection of the NRC Library at http://www.nrc.gov/reading-rm/doc-collections/. The regulatory guide is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under Accession No. ML12300A122. The regulatory analysis may be found in ADAMS under Accession No. ML121090459 and the staff responses to the public comments on DG-1282 may be found under Accession No. ML12300A121.

criteria of Appendix B apply to all activities that affect the safety-related functions of such SSCs, including activities such as designing, purchasing, installing, reviewing, testing, operating, maintaining, and modifying.

Furthermore, in 10 CFR 50.55a(a)(1), the NRC requires, in part, that systems and components be designed, fabricated, erected, tested, and inspected to quality standards commensurate with the safety function to be performed. The regulations in 10 CFR 50.55a(h) require that reactor protection and safety systems satisfy the criteria in the Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations" (including a correction sheet dated January 30, 1995) (Ref. 2), or in IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations" (Ref. 3). The criteria in these IEEE standards requires, in part, that: "Safety system equipment shall be designed, manufactured, inspected, installed, tested, operated, and maintained in accordance with a prescribed quality assurance program (ANSI/ASME NQA-l-1989)."

Diesel fuel oil for the EDGs is a safety-related component of the EGDs. As such, it is subject to the quality control requirements identified above. Because diesel fuel oil is a safety-related component, it must be "…tested, and inspected to quality standards commensurate with the safety function to be performed." Sampling the diesel fuel oil is one method of testing the safety-related component to verify that is it is capable of performing its design function. This regulatory guide endorses, in part, the sampling plan in American National Standards Institute (ANSI), American Nuclear Society (ANS) (ANSI/ANS) Standard 59.51-1997, "Fuel Oil Systems for Safety-Related Emergency Diesel Generators," (reaffirmed in October 2007), (Ref. 4) and American Society for Testing and Materials (ASTM) standard D975-13, "Standard Specification for Diesel Fuel Oils" (Ref. 5) as acceptable methods of verifying the quality of the fuel oil and fuel oil systems used in these safety-related applications at nuclear power plants.

Purpose of Regulatory Guides

The NRC issues regulatory guides (RGs) to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This RG contains information collection requirements covered by 10 CFR Part 50 and Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 6) that the Office of Management and Budget (OMB) approved under OMB control numbers 3150-0011 and 3150-0151, respectively. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Reason for Change

The NRC is issuing revision 2 of RG 1.137 to endorse portions of the updated industry consensus standard ANSI/ANS Std. 59.51-1997 and provide regulatory guidance on contemporary practices and related standards.

The NRC issued revision 1 of RG 1.137 in 1979 to endorse the guidance in ANSI Standard N195-1976, "Fuel Oil Systems for Standby Diesel-Generators" (Ref. 7) as a method acceptable to the NRC staff for complying with the Commission's regulations regarding fuel oil systems for standby diesel generators and assurance of adequate fuel oil quality. The ANSI standard was revised in 1989 to: (1) conform to revisions of ANSI/ANS-51.1, "American National Standards Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants," (Ref. 8) (now withdrawn) and ANSI/ANS-52.1, "Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants," (Ref. 9) (now withdrawn); and (2) to resolve comments from previous ballots issued in 1982 for reaffirmation, in 1985 for withdrawal, and then in 1986 for reaffirmation. The standard underwent revision again in 1997 as ANSI/ANS-59.51-1997, with reaffirmation in October 2007. However, the 2007 reaffirmation did not verify the contemporary practices or standards, and it is therefore incumbent on the user to verify the validity of the reference standards.

Background

Proper quantity and quality of fuel oil is necessary for reliable operation of the emergency diesel generators and gas turbine generators. Appendix C, "Recommended Fuel Oil Practices" to ANSI/ANS-59.51-1997, addresses recommended practices for maintaining fuel oil quantity and quality. Although not a mandatory part of the ANSI/ANS standard, the NRC staff believes Appendix C serves as an acceptable basis for a program to maintain the quality of fuel oil, with additions, deletions, and clarifications as contained in Section C, "Staff Regulatory Guidance" of this guide.

The majority of the guidance provided herein relates to the reliability and availability of the fuel oil storage and transfer system and is equally applicable to both diesel engines and gas turbines. However, the required fuel oil quality of a gas turbine may differ somewhat from that of a diesel engine. The gas turbine manufacturer's recommendations, as well as emission standards specific to gas turbines, should determine the requirements for gas turbine fuel quality. Regardless of the fuel quality provided for gas turbine performance and emissions, the level of fuel oil storage and transfer system reliability and availability should be maintained consistent with the guidance provided herein.

Harmonization with International Standards

The International Atomic Energy Agency (IAEA) has established a series of safety guides and standards constituting a high level of safety for protecting people and the environment. IAEA safety guides identify international good practices and strive to reflect the best practices to help users striving to achieve high levels of safety. Pertinent to this regulatory guide, IAEA Safety Guide No. NS-G-1.8, "Design of Emergency Power Systems for Nuclear Power Plants" (Ref. 10) issued August 2004, contains general guidance on the storage and testing of fuel and other depletable substances. This regulatory guide incorporates similar guidelines and is consistent with the basic safety principles described in IAEA safety standard NS-G-1.8.

Standards Endorsed in this Guide

This regulatory guide endorses, in part, the use of one or more codes or standards developed by external organizations, and other third party guidance documents. These codes, standards and third party guidance documents may contain references to other codes, standards or third party guidance documents ("secondary references"). If a secondary reference has itself been incorporated by reference into NRC regulations as a requirement, then licensees and applicants must comply with that standard as set forth in the regulation. If the secondary reference has been endorsed in a regulatory guide as an acceptable approach for meeting an NRC requirement, then the standard constitutes a method acceptable to the NRC staff for meeting that regulatory requirement as described in the specific regulatory guide. If the secondary reference has neither been incorporated by reference into NRC regulations nor endorsed in a regulatory guide, then the secondary reference is neither a legally-binding requirement nor a "generic" NRC approval as an acceptable approach for meeting an NRC requirement. However, licensees and applicants may consider and use the information in the secondary reference, if appropriately justified and consistent with applicable NRC requirements.

C. STAFF REGULATORY GUIDANCE

The NRC endorses, in part, the requirements for the design and testing of EDG fuel oil and fuel oil systems used in safety-related applications at nuclear power plants as described in ANSI/ANS-59.51-1997, and ASTM standard D975-13. These standards have an adequate technical basis based on established standards and provide a method acceptable to the NRC staff for complying with the pertinent NRC requirements in 10 CFR Part 50 for safety-related EDGs, subject to the clarifications and modifications described in this section.

1. Throughout ANSI/ANS-59.51-1997, other documents required to be included as part of the standard are either identified at the point of reference or described in Section 6.1, "Safety Classification and Applicable Codes, Standards, and Regulations," or in Section 7, "References," of the standard. Some of these documents have been withdrawn by the issuing organization and the edition/revision indicated for most or all of the referenced documents are not current. Except as specifically addressed in this RG, the edition/revision of each code and standard stated in ANSI/ANS-59.51-1997 should be applied to the fuel oil system.

2. The quality group classification for the fuel oil system up to the system interface with the diesel engine or gas turbine skid should be Quality Group C in accordance with RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants" (Ref. 11). The seismic classification of the fuel oil system up to the diesel engine or gas turbine skid interface should be Seismic Category I in accordance with RG 1.29, "Seismic Design Classification" (Ref. 12).

3. Section 1.1, "Scope," of ANSI/ANS-59.51-1997 states that the standard provides functional, performance, and initial design requirements for the fuel oil system for safety-related emergency diesel generators. The standard does not specifically address quality assurance, and in this regard, ANSI/ANS-59.51-1997 should be used in conjunction with RG 1.28, "Quality Assurance Program Requirements (Design and Construction)" (Ref. 13), which endorses ANSI/ASME NQA-1for activities including the design, construction, and maintenance of the fuel oil system.

4. ANSI/ANS-59.51-1997 requires, in part, that the onsite fuel oil storage capacity for each diesel generator be sufficient to operate the diesel generator following any design basis event either for 7 days or for the time required to replenish the fuel from sources outside the plant site, without

interruption of the operation of the diesel generator, whichever is longer. New reactor designs should provide independent 7 day storage capacity for each emergency power supply train diesel generator or gas turbine set. All safety-related emergency power supply fuel oil systems should include the full 7-day supply in the fuel oil supply tank and should assume that the supply cannot be replenished for at least 7 days following the design basis event. The 7 day allowance assumes sufficient offsite supplies are available for continuous replenishment for a mission time of at least 30 days credited in the plant safety analyses. Pre-disaster agreements for fuel oil replenishment should be established in the event a natural calamity invokes widespread fuel shortages or results in extended outage of the transmission network. Furthermore, with sufficient warning that a disaster is approaching, temporary diesel tanks can provide extended running time, as disaster conditions can temporarily prevent access to the plant site for replenishment of fuel oil supplies.

5. Section 5.4, "Calculation of Usable Fuel Oil Storage Requirements," of ANSI/ANS-59.51-1997 provides two methods for calculation of the required capacity for fuel oil storage. The first calculation method is based on providing onsite storage for 7 days of continuous operation at the rated diesel generator capacity and requires an explicit allowance for fuel consumption during periodic testing. Appendix B of ANSI/ANS-59.51-1997, "Alternate Calculation of Usable Fuel Oil Storage Capacity," although not a required appendix, provides the second method for calculation of fuel oil storage capacity requirements that bases the capacity on operation of the diesel generator or generators at the minimum required capacity, including the capacity to power the safety-related systems and components, for the plant condition that is most limiting for the calculation of such capacity. In view of the varying plant conditions that may prevail during emergency situations and flexibility afforded to plant operators to manually add loads, the NRC staff does not consider the time and load dependent method as acceptable for meeting the intent of onsite fuel oil storage requirements. The calculation for supply tank capacity should include the following considerations:

   5.1. Provide for a 7-day usable volume in the fuel oil supply tank and should not assume any contribution from any other fuel oil system components, including the day or integral tanks, piping, valves, transfer pumps, strainers, and filters.

   5.2. Account for the unusable volume of the fuel supply tank. This unusable volume is the volume below the elevation at which air in the tank can enter the suction piping or at which vortex effect could impact system performance. The location of this suction connection should be at an elevation that prevents influx of particulates that could plug filters and strainers and should also consider the extent of accumulation of sludge over time based on the plant's maintenance program for the supply tank.

   5.3. Account for any reduced performance when using alternative fuels or changes in energy content of available fuel oil.

   5.4. Base storage capacity calculations on the limiting heat content of the fuel oil that is specified in plant procedures.

6. Section 6.2.4, "Physical Arrangement," of ANSI/ANS-59.51-1997 states that "the location of day or integral tanks shall be as required by the diesel-engine manufacturer." In addition to this requirement, the physical location of the day tank (relative to the engine and design of the engine fuel system, including gas turbine fuel oil systems) should take into account:

   6.1. Net positive suction head requirement of the pump fed from the day tank, if applicable,

6.2. Potential need for electric fuel pumps powered from a reliable power supply to ensure that the diesel generator unit can start automatically and attains the required voltage and frequency within acceptable time, and

6.3. Assurance that flooding and other postulated hazards under design basis events will not cause system inoperability. GDC 2, "Design Bases for Protection Against Natural Phenomena," has the following requirements – Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.

7. The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components" (Ref. 14), applies to fuel oil system components that are designed to ASME B&PV Code Section III. ASME "Code for Operation and Maintenance of Nuclear Power Plants" (ASME OM Code) (Ref. 15), applies to the inservice testing of certain pumps and valves of the fuel oil system as described in Section ISTA-1100, "Scope," of the ASME OM Code.

8. Section 6.2.4 of ANSI/ANS-59.51-1997 requires that adequate heating be provided for the fuel oil system. Assurance should be provided that the fuel oil can be supplied and ignited at all times under the most severe environmental conditions expected at the facility. The guidance provided in ASTM Std. D975-13, Note J, should be applied, as needed, to ensure that reliable diesel generator and gas turbine generator operation and performance are maintained during low ambient temperature conditions.

9. Section 6.2.5, "Other Requirements," of ANSI/ANS-59.51-1997 states, in part, that "…protection shall be provided as required against external and internal corrosion, such as by coatings or cathodic protection, or both, in accordance with National Association of Corrosion Engineers (NACE) Standard RP0169-1983, 'Recommended Practice - Control of External Corrosion on Underground or Submerged Metallic Piping Systems'." (Ref. 16) The NRC staff does not endorse the 1983 revision of this NACE standard. However, applicants and licensees may find it useful. If corrosion protection is required, coatings and cathodic protection should be provided as follows:

9.1. Internal coatings applied to the safety-related components of the fuel oil system should be safety-related coatings and the selection, application, qualification, inspection, and maintenance of the coatings should be in accordance with RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants" (Ref. 17), and ASTM D5144-08e, "Use of Protective Coating Standards in Nuclear Power Plants" (Ref. 18). Protective coatings for the safety-related components of the fuel oil system should be classified as Coating Service Level III per RG 1.54. Tank interior coatings should not detach or dissolve and thereby impair the adequate and uninterrupted supply of fuel oil to the diesel generators. Coatings should prevent tank corrosion products from contaminating and fouling filters, which could starve the diesel generator of the necessary

fuel. Any qualification of coatings should be done for the expected range of fuel sulfur content.

9.2. External coatings should follow the requirements of NACE SP0169-2007, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems," (Ref. 19) which is endorsed by the NRC staff in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report" (Ref. 20), Section XI.M41, "Buried and Underground Piping and Tanks." Section 5 of NACE SP0169-2007 contains a list of acceptable types of external coatings and the standards to which these coatings should comply. With the exception of installations where it can be demonstrated that external corrosion control is not required (paragraphs 1.2.1-1.2.3 and section 3 of NACE SP0169-2007), paragraph 4.2.1 of NACE SP0169-2007 states, in part, "External corrosion control must be a primary consideration during the design of a piping system. Materials selection and coatings are the first line of defense against external corrosion. Because perfect coatings are not feasible, CP [cathodic protection] must be used in conjunction with coatings."

9.3. When provided, cathodic protection systems should be designed, operated, maintained and tested in accordance with NACE SP0169-2007.

10. Section 6.2.5 of ANSI/ANS-59.51-1997 includes requirements for fire protection for the diesel generator fuel oil system. The requirements of Section 6.2.5 are not endorsed by this RG because this subject is addressed separately in more detail in other NRC documents. Thus a commitment to follow this RG does not imply a commitment to follow the requirements of Section 6.2.5 concerning fire protection. Fire protection for the fuel oil systems for diesel generators and gas turbine generators should be provided in accordance with RG 1.189, "Fire Protection for Nuclear Power Plants" (Ref. 21) and meet the requirements of Appendix R of 10 CFR Part 50.

11. Section 6.3.3, "Instrumentation and Controls," of ANSI/ANS-59.51-1997 provides requirements for controls, instrumentation and alarms. The system should include sufficient instrumentation and alarms, both in the main plant control room and at each diesel generator or gas turbine generator local control panel, to permit operators to adequately monitor the fuel oil supply and the performance of the fuel oil system to ensure that the fuel oil system can continue to perform the required safety function during a design basis event.

12. When conducting maintenance on fuel oil supply systems, licensees should ensure practices are consistent with manufacturer recommendations including the use of specialized tools and techniques.

13. ANSI/ANS-59.51-1997, Appendix C, and ASTM D975-13, including Table 1, should be used as a basis for a program to ensure the initial and continuing quality of fuel oil as supplemented by the following:

13.1. The reference in ANSI/ANS-59.51-1997 to ANSI/ASTM D2276-94 for periodic manual sampling of the stored fuel should be changed to ASTM D6217-11, "Standard Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration" (Ref. 22). Test method ASTM D4057-06 (Reapproved in 2011), "Practice for Manual Sampling of Petroleum and Petroleum Products" (Ref. 23) should be used to collect fuel oil test samples of new fuel for analysis prior to adding the oil to the supply tanks.

13.2. Appendix C to ANSI/ANS-59.51-1997 specifies that prior to the addition of fuel oil to the supply tank, the API gravity or specific gravity should be measured and should be within the ranges specified. The test for API or specific gravity should be performed in accordance with ASTM D1298-12b, "Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method" (Ref. 24).

13.3. Before adding new fuel oil to the supply tanks, onsite samples of the new fuel oil should be taken. As a minimum, before the addition of new fuel, tests for the following properties should be conducted:

13.3.1. specific or API gravity,
13.3.2. water and sediment or clear and bright with proper color,
13.3.3. viscosity, and
13.3.4. flash point.

Test results for these properties should be in accordance with the limits specified in the applicable specification. Analysis of the other properties listed in Table 1 of ASTM D975-13 should be completed within 31 days of new fuel delivery, in accordance with ASTM D975-13 or ANSI/ANS-59.51-1997

13.4. Accumulated condensate should be removed from supply tanks on a monthly basis.

13.5. Day tanks and integral tanks should be checked for water monthly, as a minimum, and after each operation of the diesel where the period of operation was 1 hour or longer. The presence of water should be verified in accordance with ASTM D2709-96 (Reapproved 2011), "Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge" (Ref. 25), or ASTM D1796-11, "Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)" (Ref. 26). The level should not exceed the maximum specified in Table 1 of ASTM D975-13. Accumulated water should be removed immediately. If water ingress is suspected from the suction piping of the day tank or integral tank, then the entire fuel oil system between the day tank or integral tank and the injectors should be flushed with fresh fuel oil.

13.6. As a minimum, the fuel oil stored in the supply tanks should be removed, the accumulated sediment removed, the tanks cleaned, and the interior inspected at 10-year intervals.

Licensees should prevent the introduction of surfactants from soap and detergents into the system during cleaning. Licensees should also be aware that using strong oxidizing cleaning agents (e.g. high concentrations of sodium hypochlorite) could release noxious fumes or cause uncontrolled chemical reactions and use the appropriate precautions if using these chemicals. Other materials with cleaning properties equivalent to high concentrations of sodium hypochlorite can be used to clean fuel oil supply tanks. NRC Information Notice (IN) 2002-07, "Use of Sodium Hypochlorite for Cleaning Diesel Fuel Oil Supply Tanks" (Ref. 27), discusses the potential problems related to the use of sodium hypochlorite solutions for cleaning diesel fuel oil supply tanks.

13.7. Licensees should add fuel oil carefully to the supply tank to avoid suspension of settled particles. This prevents tainting the fuel supply with suspended material.

13.8. Efforts to monitor on-hand fuel supply must be diligent to ensure reliability and availability of the fuel oil system. These include the aforementioned ASTM test procedures and biological cultures (for fungus and bacteria) in accordance with ASTM D6469-11 "Standard Guide for Microbial Contamination in Fuels and Fuel Systems" (Ref. 28).

Fuel oil degradation during long term storage shows up as an increase in particulate, due mostly to oxidation. The presence of particulate does not mean the fuel oil will not burn properly in a diesel engine. The particulate can cause fouling of filters and fuel oil injection equipment, however, which can cause engine failure. Particulate concentrations should be determined in accordance with ASTM D6217-11.

Recirculation (continuous) treatment systems can improve existing fuel quality, extend fuel life, and refresh stockpiles. Such systems have the potential to remove water, remove solids (down to 2 micrometers), and discourage bacterial growth. These systems can provide the following benefits:

13.8.1. A representative sample of the treated fuel satisfies the licensee technical specification in relation to fuel quality and overall system availability, and

13.8.2. The system conforms to the requirements in ANSI/ANS 59.51-1997.

13.9. Applicants for a license renewal should establish a program focused on managing loss of material due to general, pitting, crevice and microbiologically-influenced corrosion (MIC) and fouling that leads to corrosion of the fuel tank internal surfaces, as described in NUREG-1801, Section XI.M30, "Fuel Oil Chemistry."

13.10. The NRC does not regulate emissions from emergency power supply drivers and consequently does not provide specific guidance for the level of sulfur in the fuel oil. However if ultra-low-sulfur diesel (ULSD) (i.e., a maximum of 15 ppm sulfur) (S15) grade fuel oil is used, the oil stored in the fuel oil supply tank, and the oil to be used for filling or refilling the supply tank, should meet the requirements of ASTM D975-13 (because the use of ASTM D975-06 and some earlier editions do not address ULSD fuel) and the diesel generator or gas turbine manufacturer's requirements. The process used to reduce sulfur may also change other properties of diesel fuel. The potential changes are expected to include lower energy content (of the order of 1% to 2%), different cetane number, greater tendency to form particulates in storage, lower lubricity, and reduced compatibility with gaskets, seals, and engine lubricating oil. NRC IN 2006-22, "New Ultra-Low Sulfur Diesel Fuel Oil Could Adversely Impact Diesel Engine Performance" (Ref. 29), describes some of the properties of ULSD fuel and the potential effects on engine performance. Licensees should be aware of the potential impacts of ULSD and verify the quality and compatibility of the fuel in accordance with ASTM D975-13 and the supplements listed in this section.

13.11. Biologically based diesel fuels (also known as "biodiesel"), of any concentration, should be used with caution because of the uncertainty about the chemical and physical properties of the formulations and their potential impact on diesel performance and fuel oil system components. This includes ethanol-fortified grades. ASTM D975-13 considers blends with up to 5% biodiesel not to be a biodiesel grade. Therefore, licensees should not assume that purchased diesel fuel is free of any biodiesel without verification by the supplier before adding new fuel oil to the supply tanks. An oxidation stability

issue is known to affect biodiesel fuel during long term storage. This configuration would apply to nuclear power plants where the diesel fuel (that may contain a blend of biodiesel) is stored for long periods of time. NRC IN 2009-02, "Biodiesel in Fuel Oil Could Adversely Impact Diesel Engine Performance" (Ref. 30), identifies several potential problems associated with a 5% biodiesel (B5) and suggests actions to mitigate the problems. Electric Power Research Institute (EPRI) reports, "Plant Support Engineering: Storage and Use of Low-Concentration (5%) Biodiesel Blends in Nuclear Plant Emergency Diesel Generators," dated December 2010 (Ref. 31), and "Plant Engineering: Storage and Use of Low-Concentration (5%) Biodiesel Blends in Nuclear Plant Emergency Diesel Generators, Addendum: Fuel Storage Test and Contingency Plan," dated March 2011 (Ref. 32), provide information on the use of B5 fuel for emergency diesel generators.

D. IMPLEMENTATION

The purpose of this section is to provide information on how applicants and licensees[1] may use this guide and information regarding the NRC's plans for using this regulatory guide. In addition, it describes how the NRC staff complies with 10 CFR 50.109, "Backfitting" and any applicable finality provisions in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

Use by Applicants and Licensees

Applicants and licensees may voluntarily[2] use the guidance in this document to demonstrate compliance with the underlying NRC regulations. Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations. Current licensees may continue to use guidance the NRC found acceptable for complying with the identified regulations as long as their current licensing basis remains unchanged.
Licensees may use the information in this regulatory guide for actions which do not require NRC review and approval such as changes to a facility design under 10 CFR 50.59, "Changes, Tests, and Experiments." Licensees may use the information in this regulatory guide or applicable parts to resolve regulatory or inspection issues.

Use by NRC Staff

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this regulatory guide. The NRC staff does not expect any existing licensee to use or commit to using the guidance in this regulatory guide, unless the licensee makes a change to its licensing basis. The NRC staff does not expect or plan to request licensees to voluntarily adopt this regulatory guide to resolve a generic regulatory issue. The NRC staff does not expect or plan to initiate NRC regulatory action which would require the use of this regulatory guide. Examples of such unplanned NRC regulatory actions include issuance of an order requiring the use of the regulatory guide, requests for information under 10 CFR 50.54(f) as to whether a licensee intends to commit to use of this regulatory guide, generic

1 In this section, "licensees" refers to licensees of nuclear power plants under 10 CFR Parts 50 and 52; and the term "applicants," refers to applicants for licenses and permits for (or relating to) nuclear power plants under 10 CFR Parts 50 and 52, and applicants for standard design approvals and standard design certifications under 10 CFR Part 52.

2 In this section, "voluntary" and "voluntarily" means that the licensee is seeking the action of its own accord, without the force of a legally binding requirement or an NRC representation of further licensing or enforcement action.

communication, or promulgation of a rule requiring the use of this regulatory guide without further backfit consideration.

During regulatory discussions on plant specific operational issues, the staff may discuss with licensees various actions consistent with staff positions in this regulatory guide, as one acceptable means of meeting the underlying NRC regulatory requirement. Such discussions would not ordinarily be considered backfitting even if prior versions of this regulatory guide are part of the licensing basis of the facility. However, unless this regulatory guide is part of the licensing basis for a facility, the staff may not represent to the licensee that the licensee's failure to comply with the positions in this regulatory guide constitutes a violation.

If an existing licensee voluntarily seeks a license amendment or change and (1) the NRC staff's consideration of the request involves a regulatory issue directly relevant to this new or revised regulatory guide and (2) the specific subject matter of this regulatory guide is an essential consideration in the staff's determination of the acceptability of the licensee's request, then the staff may request that the licensee either follow the guidance in this regulatory guide or provide an equivalent alternative process that demonstrates compliance with the underlying NRC regulatory requirements. This is not considered backfitting as defined in 10 CFR 50.109(a)(1) or a violation of any of the issue finality provisions in 10 CFR Part 52.

Additionally, an existing applicant may be required to comply to new rules, orders, or guidance if 10 CFR 50.109(a)(3) applies.

If a licensee believes that the NRC is either using this regulatory guide or requesting or requiring the licensee to implement the methods or processes in this regulatory guide in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfit appeal with the NRC in accordance with the guidance in NUREG-1409, "Backfitting Guidelines," (Ref. 33) and the NRC Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection" (Ref. 34).

REFERENCES[3]

1. *U. S. Code of Federal Regulations* (CFR) "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy."

2. Institute of Electrical and Electronic Engineers (IEEE), Standard 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Generating Stations," Piscataway, NJ.[4]

3. IEEE, Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," Piscataway, NJ.

4. American National Standards Institute (ANSI), American Nuclear Society (ANS), ANSI/ANS-59.51-1997, "Fuel Oil Systems for Safety-Related Emergency Diesel Generators," with reaffirmation in October 2007, La Grange Park, IL. [5]

5. American Society for Testing and Materials (ASTM), Std. D975-13, "Standard Specification for Diesel Fuel Oils," West Conshohocken, PA. [6]

6. CFR, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Part 52, Chapter 1, Title 10, "Energy."

7. ANS Standard N195-1976, "Fuel Oil Systems for Standby Diesel-Generators," La Grange Park, IL.

8. ANSI/ANS-51.1, "Fuel Oil Systems for Safety-Related Emergency Diesel Generators," (withdrawn) ANS, La Grange Park, IL.

9. ANSI/ANS-52.1, "Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants," (withdrawn), ANS, La Grange Park, IL.

10. International Atomic Energy Agency (IAEA), Safety Guide NS-G-1.8, "Design of Emergency Power Systems for Nuclear Power Plants" issued August 2004, Vienna, Austria.[7]

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3 Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public Web site at: http://www.nrc.gov/reading-rm/doc-collections/. The documents can also be viewed on-line or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail pdr.resource@nrc.gov.

4 Copies of Institute of Electrical and Electronics Engineers (IEEE) documents may be purchased from the Institute of Electrical and Electronics Engineers Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855 or through the IEEE's public Web site at http://www.ieee.org/publications_standards/index.html.

5 Copies of American Nuclear Society (ANS) standards may be purchased from the ANS Web site http://www.new.ans.org/store/; or by writing to: American Nuclear Society, 555 North Kensington Avenue, La Grange Park, Illinois 60526, U.S.A., Telephone 800-323-3044.

6 Copies of American Society for Testing and Materials (ASTM) standards may be purchased from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959; telephone (610) 832-9585. Purchase information is available through the ASTM Web site at http://www.astm.org.

7 Copies of International Atomic Energy Agency (IAEA) documents may be obtained through their Web site: WWW.IAEA.Org/ or by writing the International Atomic Energy Agency P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria. Telephone (+431) 2600-0, Fax (+431) 2600-7, or E-Mail at Official.Mail@IAEA.Org

11. U.S. Nuclear Regulatory Commission (NRC), Regulatory Guide (RG) 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Washington, DC.

12. NRC, RG 1.29, "Seismic Design Classification," Washington, DC.

13. NRC, RG 1.28, "Quality Assurance Program Requirements (Design and Construction)," Washington, DC.

14. ASME, Boiler and Pressure Vessel (B&PV) Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," New York, NY.

15. ASME, B&PV Code Section III, "Code for Operation and Maintenance of Nuclear Power Plants" (ASME OM Code), New York, NY.

16. National Association of Corrosion Engineers, International (NACE), Standard RP0169-1983, "Recommended Practice - Control of External Corrosion on Underground or Submerged Metallic Piping Systems," NACE International, Houston, TX.[8]

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20. NRC, NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Washington, DC.

21. NRC, RG 1.189, "Fire Protection for Nuclear Power Plants," Washington, DC.

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23. ASTM Std. D4057-06 (Reapproved in 2011), "Practice for Manual Sampling of Petroleum and Petroleum Products," West Conshohocken, PA.

24. ASTM Std. D1298-12b, "Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method" West Conshohocken, PA.

25. ASTM Std. D2709-96 (Reapproved 2011), "Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge," West Conshohocken, PA.

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8 Copies of NACE International standards may be purchased from NACE International, 1440 South Creek Drive, Houston, TX, 77084-4906; telephone (281) 228-6200 or (800) 797-6223; Fax: (281) 228-6300; E-mail: firstservice@nace.org

26. ASTM Std. D1796-11, "Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)," West Conshohocken, PA.

27. NRC, Information Notice, (IN) 2002-07, "Use of Sodium Hypochlorite for Cleaning Diesel Fuel Oil Supply Tanks," Washington, DC. (ADAMS Accession No. ML013450182)

28. ASTM Std. D6469-11, "Standard Guide for Microbial Contamination in Fuels and Fuel Systems," West Conshohocken, PA.

29. NRC, IN 2006-22, "New Ultra-Low-Sulfur Diesel Fuel Oil Could Adversely Impact Diesel Engine Performance," Washington, DC. (ADAMS Accession No. ML062710079)

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33. NRC, NUREG-1409, "Backfitting Guidelines," July 1990, Washington, DC. (ADAMS Accession No. ML032230247)

34. NRC, Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection," Washington, DC.

9 Copies of Electric Power Research Institute (EPRI) documents may be obtained by contacting the Electric Power Research Institute, 3420 Hillview Avenue, Palo Alto, CA 94304, Telephone: 650-855-2000 or on-line at http://my.epri.com/portal/server.pt.