UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
OFFICE OF NEW REACTORS
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
WASHINGTON, DC 20555-0001

February 23, 2009

NRC INFORMATION NOTICE 2009-02: BIODIESEL IN FUEL OIL COULD ADVERSELY IMPACT DIESEL ENGINE PERFORMANCE

ADDRESSEES

All holders of operating licenses for nuclear power reactors and fuel cycle facilities, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel; all current and potential applicants for an early site permit, combined license, or standard design certification for a nuclear power plant under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants"; all current holders of and potential applicants for construction permits under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities"; and all licensees and potential applicants for new fuel cycle facilities under 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert licensees to the potential for diesel fuel oil to contain up to 5-percent biodiesel (B5), which could adversely impact engine performance. The NRC expects recipients to review the information for applicability to their facilities and to consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

On June 19, 2008, the American Society for Testing and Materials (ASTM) International D02 Main Committee approved a revision to the conventional petrodiesel standard specification. The revised standard, ASTM D975-08a, "Standard Specification for Diesel Fuel Oils," now permits No. 2 diesel fuel to contain up to a B5 blend and still be considered the same without labeling the blend. The changes to this standard will take effect within 3 to 5 months after the October 13, 2008, publication date of the final standard. The introduction of biodiesel blends into the No. 2 diesel fuel supply raises potential generic applicability and common-cause failure concerns because of the possibly adverse physical properties associated with biodiesel use in diesel engines including the safety-related emergency diesel generators (EDGs).

Examples of diesel engines providing functions important to safety include EDGs, diesel-driven fire pumps, diesel-driven auxiliary feedwater pumps, diesel-driven essential service water makeup pumps, diesel-driven instrument air compressors, security diesel generators, safe-

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shutdown facility diesel generators, diesel generators for emergency preparedness and response functions, and station blackout diesel generators. The U.S. Department of Energy has stated that biodiesel blends of B5 or less do not cause noticeable differences in performance compared to No. 2 diesel fuel. However, for the reasons discussed below, a B5 blend could be problematic for EDGs and diesel engines that provide functions important to safety.

Cleaning Effect

B5 can have a cleaning effect that loosens accumulated sediment in fuel oil storage tanks that previously stored conventional diesel fuel. This sediment can then plug filters and other equipment in the fuel oil system. To prevent the buildup of this sediment, licensees may take the following actions:

- Clean fuel oil storage tanks before putting B5 in them.
- Add and/or upgrade the filters in the fuel oil system.

Licensees can expect to change and/or clean filters more frequently, especially during the early stages of B5 use.

Water

B5 contains suspended particles of water from the manufacturing process. This water will, in time, fall out of suspension and form “dirty water” in the fuel oil storage tank, which eventually leads to the formation and growth of algae. To prevent the formation of dirty water and the subsequent growth of algae, licensees may take the following actions:

- Use a moisture dispersant and biocide in fuel oil storage tanks containing B5.
- Add a fuel/water separator to the fuel oil system.
- Keep fuel oil storage tanks topped off to minimize in-tank condensation.

Biodegradation

B5 is biodegradable, and the presence of water, heat, oxygen, and other impurities accelerate the degradation of the fuel supply. To avoid damage caused by fuel degradation, licensees may consider not using B5 if it has been stored for an extended period of time (approximately 3 to 6 months or longer).

Material Incompatibility

Brass, bronze, copper, lead, tin, and zinc in tanks and fittings may accelerate the oxidation process of B5, creating fuel insolubles or gels and salts. Licensees should avoid using zinc linings, copper pipes and fittings, and brass regulators with B5.

Licensees should verify that elastomeric materials, such as hoses, gaskets, and O-rings, and their inspection and maintenance, are compatible with B5 and its effects.

Temperature Protection

Biodiesel components have higher cloud points (the temperature at which solid particles start to form, or gel) than standard (petroleum) diesel components. The cloud point also varies considerably with the source of the biodiesel component, which is not specified in B5 blends. Clouding may also combine with suspended particles of water and exacerbate adverse cold temperature concerns. Consequently, licensees should evaluate and ensure adequate low temperature protection for all diesel generator system components.

Housekeeping

Biodiesel is a good solvent. If it is left on a painted surface long enough, it can dissolve certain types of paints. Licensees should check for compatibility with paints they use, and should immediately wipe any B5 spills from painted surfaces.

BACKGROUND

Applicable Regulatory Documents

General Design Criterion 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, requires that onsite and offsite electric power systems be provided to permit the functioning of structures, systems, and components important to safety. In addition, General Design Criterion 17 contains requirements for system capacity, capability, independence, redundancy, availability, testability, and reliability. Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, establishes overall quality assurance requirements for the design, construction, and operation of structures, systems, and components important to safety.

Regulatory Guide (RG) 1.137, "Fuel Oil Systems for Standby Diesel Generators," Revision 1, issued October 1979, describes a method that the NRC staff finds acceptable for complying with the Commission's regulations on diesel fuel oil systems for standby diesel generators and assurance of adequate quality of diesel fuel oil. RG 1.137 states that licensees should use Appendix B to American National Standards Institute N195-1976 as a basis for a program to ensure the initial and continuing quality of diesel fuel oil as supplemented by eight additional provisions in RG 1.137 for maintaining the properties and quality of diesel fuel oil.

Related NRC Generic Communications

NRC IN 2006-22, "New Ultra-Low-Sulfur Diesel Fuel Oil Could Adversely Impact Diesel Engine Performance," dated October 12, 2006, alerts addresses to the potential of new ultra-low-sulfur diesel fuel oil to adversely impact diesel engine performance.

NRC IN 96-67, "Vulnerability of Emergency Diesel Generators to Fuel Oil/Lubricating Oil Incompatibility," dated December 19, 1996, alerts addressees to a finding that involves the degradation of the power block assembly of two EDGs caused by an incompatibility of the lubricating oil with a low-sulfur-content diesel fuel oil.

NRC IN 94-19, “Emergency Diesel Generator Vulnerability to Failure From Cold Fuel Oil,” dated March 16, 1994, alerts addressees to a safety problem that could lead to the common mode failure of all emergency diesel generator units as a result of temperature-related changes in the fuel oil.

NRC IN 91-46, “Degradation of Emergency Diesel Generator Fuel Oil Delivery Systems,” dated July 18, 1991, alerts addressees to the potential inoperability of multiple EDGs resulting from two common-cause degradations:

(1) degraded diesel fuel oil delivery systems, and

(2) the failure of the licensee to meet technical specification testing requirements intended to detect the potentially degraded quality of the diesel fuel oil stored on site.

NRC Generic Letter 83-26, “Clarification of Surveillance Requirements for Diesel Fuel Impurity Level Tests,” provides licensees with revised surveillance requirements for tests of the impurity level in diesel fuel oil to clearly reflect the relationship between the standard technical specification testing requirements for impurity levels in diesel fuel oil; guidance given in RG 1.137, Revision 1, and American National Standards Institute N195-1976 (ASTM D270, ASTM D975, and ASTM D2274); and the NRC staff review performed in accordance with Section 9.5.4 of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants.”

DISCUSSION

The conventional petrodiesel standard specification, ASTM D975-08a, has been revised to permit No. 2 diesel fuel to contain up to a B5 blend and still be considered the same without labeling the blend. Licensees may start receiving B5 in the near future. As described above, B5 has a number of characteristics that could potentially degrade or render inoperable the associated diesel engine or may create a condition that is inconsistent with current plant design and licensing bases. This B5 issue is of particular concern because it could potentially affect licensee diesel generators that are safety related and/or important to safety, thereby presenting a possible common-mode failure. Licensees can evaluate the potential impacts of B5 and can act to ensure that their plants are consistent with the current design and licensing bases and to prevent the diesels from being rendered inoperable or significantly degraded.

CONTACT

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below.

/RA/

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

/RA/

Glenn Tracy, Director
Division of Construction Inspection and Operational Programs
Office of New Reactors

/RA/

Daniel Dorman, Director
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Materials Safety and Safeguards

Technical Contacts: Robert Wolfgang, NRR
301-415-1624
e-mail: robert.wolfgang@nrc.gov

Omid Tabatabai, NRO
301-415-6616
e-mail: omid.tabatabai@nrc.gov

Note: NRC generic communications may be found on the NRC public Web site, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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Technical Contacts: Robert Wolfgang, NRR
301-415-1624
e-mail: robert.wolfgang@nrc.gov

Omid Tabatabai, NRO
301-415-6616
e-mail: omid.tabatabai@nrc.gov

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