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U.S. NUCLEAR REGULATORY COMMISSION

Draft Regulatory Guide: Issuance, Availability

The U.S. Nuclear Regulatory Commission (NRC) has issued for public comment a draft of a new guide in the agency's Regulatory Guide Series. This series has been developed to describe and make available to the public such information as methods that are acceptable to the NRC staff for implementing specific parts of the NRC's regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff needs in its review of applications for permits and licenses.

The draft regulatory guide, entitled "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors," is temporarily identified by its task number, DG-1144, which should be mentioned in all related correspondence. This proposed regulatory guide describes a method that the NRC staff considers acceptable for use in complying with the agency's regulations in Title 10, Part 50, of the Code of Federal Regulations (10 CFR Part 50), "Domestic Licensing of Production and Utilization Facilities." Specifically, in Appendix A to10 CFR Part 50, General Design Criterion (GDC) 1, "Quality Standards and Records," requires, in part, that structures, systems, and components that are important to safety must be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function performed. In addition, GDC 30, "Quality of Reactor Coolant Pressure Boundary," requires, in part, that components that are part of the reactor coolant pressure boundary must be designed, fabricated, erected, and tested to the highest practical quality standards.

Augmenting those design criteria, 10 CFR 50.55a, "Codes and Standards," endorses the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code for design of safety-related systems and components. In particular, Section 50.55a(c), "Reactor Coolant Pressure Boundary," requires, in part, that components of the reactor coolant pressure

boundary must be meet the requirements for Class 1 components in Section III, “Rules for Construction of Nuclear Power Plant Components,” of the ASME Boiler and Pressure Vessel Code. Specifically, those Class 1 requirements contain provisions, including fatigue design curves, for determining a component’s suitability for cyclic service. These fatigue design curves are based on strain-controlled tests performed on small polished specimens, at room temperature, in air environments. Thus, these curves do not address the impact of the reactor coolant system environment.

This draft regulatory guide provides guidance for use in determining the acceptable fatigue life of ASME pressure boundary components, with consideration of the light-water reactor (LWR) environment. In so doing, this guide describes a methodology that the NRC staff considers acceptable to support reviews of applications that the agency expects to receive for new nuclear reactor construction permits or operating licenses under 10 CFR Part 50, design certifications under 10 CFR Part 52, and combined licenses under 10 CFR Part 52 that do not reference a standard design. Because of significant conservatism in quantifying other plant-related variables (such as cyclic behavior, including stress and loading rates) involved in cumulative fatigue life calculations, the design of the current fleet of reactors is satisfactory, and the plants are safe to operate.

The ASME Section III design curves, developed in the late 1960s and early 1970s, are based on tests conducted in laboratory air environments at ambient temperatures. The original code developers applied margins of 2 on strain and 20 on cyclic life to account for variations in materials, surface finish, data scatter, and environmental effects (including temperature differences between specimen test conditions and reactor operating experience). However, the developers lacked sufficient data to explicitly evaluate and account for the degradation attributable to exposure to aqueous coolants. More recent fatigue test data from the United States, Japan, and elsewhere show that the LWR environment can have

a significant impact on the fatigue life of carbon and low-alloy steels, as well as austenitic stainless steel.

Two distinct methods can be used to incorporate LWR environmental effects into the fatigue analysis of ASME Class 1 components. The first method involves developing new fatigue curves that are applicable to LWR environments. Given that the fatigue life of ASME Class 1 components in LWR environments is a function of several parameters, this method would necessitate developing several fatigue curves to address potential parameter variations. An alternative would be to develop a single bounding fatigue curve, which may be overly conservative for most applications. The second method involves using an environmental correction factor (F_{en}) to account for LWR environments by correcting the fatigue usage calculated with the ASME "air" curves. This method affords the designer greater flexibility to calculate the appropriate impacts for specific environmental parameters. In addition, applicants have already used this method in their license renewal applications.

The NRC staff has selected the F_{en} method, as described in NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials." In particular, Appendix A to that report, "Incorporating Environmental Effects into Fatigue Evaluations," describes a methodology that the staff considers acceptable to incorporate the effects of reactor coolant environments on fatigue usage factor evaluations of metal components. In addition, NUREG/CR-6909 provides a comprehensive review of, and technical basis for, the methodology proposed in this draft regulatory guide, including analysis of each parameter affecting the fatigue evaluations.

The NRC staff is soliciting comments on both Draft Regulatory Guide DG-1144 and NUREG/CR-6909. Comments may be accompanied by relevant information or supporting data. Please mention DG-1144 and/or NUREG/CR-6909 in the subject line of your comments. Comments submitted in writing or in electronic form will be made available to the public in their entirety through the NRC's Agencywide Documents Access and Management System (ADAMS).

Personal information will not be removed from your comments. You may submit comments by any of the following methods.

Mail comments to: Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Email comments to: NRCREP@nrc.gov. You may also submit comments via the NRC's rulemaking Web site at http://ruleforum.llnl.gov. Address questions about our rulemaking Web site to Carol A. Gallagher (301) 415-5905; email CAG@nrc.gov.

Hand-deliver comments to: Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, 11555 Rockville Pike, Rockville, Maryland 20852, between 7:30 a.m. and 4:15 p.m. on Federal workdays.

Fax comments to: Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission at (301) 415-5144.

Requests for technical information about Draft Regulatory Guide DG-1144 may be directed to Hipolito J. Gonzalez at (301) 415-0068 or by email to HJG@nrc.gov.

Comments would be most helpful if received by **September 25, 2006**. Comments received after that date will be considered if it is practical to do so, but the NRC is able to ensure consideration only for comments received on or before this date. Although a time limit is given, comments and suggestions in connection with items for inclusion in guides currently being developed or improvements in all published guides are encouraged at any time.

Electronic copies of the draft regulatory guide are available through the NRC's public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC's Electronic Reading Room at http://www.nrc.gov/reading-rm/doc-collections/. Electronic copies are also available in ADAMS (http://www.nrc.gov/reading-rm/adams.html), under Accession #ML060970173.

Electronic copies of NUREG/CR-6909 are available through the NRC's public Web site at http://www.nrc.gov/reading-rm/doc-collections/nuregs/ docs4comment.html. NUREG/CR-6909 is also available through ADAMS (http://www.nrc.gov/reading-rm/adams.html,, under Accession No. ML061650347.

In addition, regulatory guides and NUREG-series reports are available for inspection at the NRC's Public Document Room (PDR), which is located at 11555 Rockville Pike, Rockville, Maryland; the PDR's mailing address is USNRC PDR, Washington, DC 20555-0001. The PDR can also be reached by telephone at (301) 415-4737 or (800) 397-4205, by fax at (301) 415-3548, and by email to PDR@nrc.gov. Requests for single copies of draft or final guides (which may be reproduced) or for placement on an automatic distribution list for single copies of future draft guides in specific divisions should be made in writing to the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Reproduction and Distribution Services Section; by email to DISTRIBUTION@nrc.gov; or by fax to (301) 415-2289. Telephone requests cannot be accommodated.

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(5 U.S.C. 552(a))

Dated at Rockville, Maryland, this 17th day of July, 2006.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION,

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Division of Fuel, Engineering & Radiological Research
Office of Nuclear Regulatory Research