

Dated: May 23, 2018.

**Mark L. Banks,**

*Chief, Technical Support Branch, Advisory Committee on Reactor Safeguards.*

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## **NUCLEAR REGULATORY COMMISSION**

**[NRC-2014-0244]**

### **Guidelines for Evaluating the Effects of Light-Water Reactor Water Environments in Fatigue Analyses of Metal Components**

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** Regulatory guide; issuance.

**SUMMARY:** The U.S. Nuclear Regulatory Commission (NRC) is issuing Revision 1 to Regulatory Guide (RG) 1.207, “Guidelines for Evaluating the Effects of Light-Water Reactor Water Environments in Fatigue Analyses of Metal Components.” This RG describes methods and procedures that the staff of the NRC considers acceptable for use in determining the acceptable fatigue lives of components evaluated by a cumulative usage factor calculation in accordance with the fatigue design provisions in Section III, “Rules for Construction of Nuclear Power Plant Components,” of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code to account for the effects of light-water reactor water environments.

**DATES:** Revision 1 to RG 1.207 is available on June 5, 2018.

**ADDRESSES:** Please refer to Docket ID NRC-2014-0244 when contacting the NRC about the availability of information regarding this document. You may obtain publicly-available information related to this document using any of the following methods:

- *Federal Rulemaking Website:* Go to <http://www.regulations.gov> and search for Docket ID NRC-2014-0244. Address questions about NRC dockets to Jennifer Borges; telephone: 301-287-9127; email: [Jennifer.Borges@nrc.gov](mailto:Jennifer.Borges@nrc.gov). For technical questions, contact the individuals listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.

- *NRC’s Agencywide Documents Access and Management System (ADAMS):* You may obtain publicly available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select “ADAMS Public Documents” and then

select “Begin Web-based ADAMS Search.” For problems with ADAMS, please contact the NRC’s Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by email to [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov). RG 1.207, “Guidelines for Evaluating the Effects of Light-Water Reactor Water Environments in Fatigue Analyses of Metal Components,” is available in ADAMS under Accession No. ML16315A130.

- *NRC’s PDR:* You may examine and purchase copies of public documents at the NRC’s PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

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#### **FOR FURTHER INFORMATION CONTACT:**

Robert Tregoning, Office of Nuclear Regulatory Research, telephone: 301-415-2324, email: [Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov) and Stephen Burton, Office of Nuclear Regulatory Research, telephone: 301-415-7000, [Stephen.Burton@nrc.gov](mailto:Stephen.Burton@nrc.gov). Both are staff of the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

#### **SUPPLEMENTARY INFORMATION:**

##### **I. Discussion**

The NRC is issuing a revision to an existing guide in the NRC’s “Regulatory Guide” series. This series was developed to describe and make available to the public information regarding methods that are acceptable to the NRC staff for implementing specific parts of the agency’s regulations, techniques that the NRC staff uses in evaluating specific issues or postulated events, and data that the NRC staff needs in its review of applications for permits and licenses.

Revision 1 of RG 1.207 was issued with a temporary identification of Draft Regulatory Guide, DG-1309. This RG describes methods and procedures that the NRC staff considers acceptable for use in determining the acceptable fatigue lives of components evaluated by a cumulative usage factor calculation in accordance with the fatigue design provisions in Section III, “Rules for Construction of Nuclear Power Plant Components,” of the American Society of Mechanical Engineers’ Boiler and Pressure Vessel Code to account for the effects of light-water reactor water environments.

##### **II. Additional Information**

The NRC published a notice of the availability of DG-1309 in the **Federal Register** on November 24, 2014 (79 FR 69884), for a 60-day public comment

period. The public comment period closed on January 24, 2015. Public comments on DG-1309 and the NRC staff’s responses to the public comments are available in ADAMS under Accession No. ML16315A127.

##### **III. Congressional Review Act**

This RG is a rule as defined in the Congressional Review Act (5 U.S.C. 801-808). However, the Office of Management and Budget has not found it to be a major rule as defined in the Congressional Review Act.

##### **IV. Backfitting and Issue Finality**

This RG describes methods and procedures that the NRC staff considers acceptable for use in applications for license renewal and subsequent license renewal in determining the acceptable fatigue lives of components evaluated by a cumulative usage factor calculation in accordance with the fatigue design provisions in Section III, “Rules for Construction of Nuclear Power Plant Components,” of the ASME Code. This RG also supports reviews of applications for new nuclear reactor construction permits or operating licenses under part 50 of title 10 of the *Code of Federal Regulations* (10 CFR), design certifications under 10 CFR part 52, and combined licenses under 10 CFR part 52, which do not cite a standard design, in addition to renewed operating licenses under 10 CFR part 54. This RG may also be used by existing holders of combined licenses and operating licenses in accordance with their existing licensing basis and applicable regulatory requirements.

This RG does not constitute backfitting as defined in 10 CFR 50.109 (the Backfit Rule) and is not otherwise inconsistent with the issue finality provisions in 10 CFR part 52.

Applicants and potential applicants are not, with certain exceptions, protected by either the Backfit Rule or any issue finality provisions under 10 CFR part 52. Neither the Backfit Rule nor the issue finality provisions under 10 CFR part 52, with certain exclusions discussed below, were intended to apply to every NRC action that substantially changes the expectations of current and future applicants.

The exceptions to the general principle are applicable whenever a combined license applicant references a part 52 license (*i.e.*, an early site permit or a manufacturing license) and/or part 52 regulatory approval (*i.e.*, a design certification rule or design approval). The NRC staff does not, at this time, intend to impose the positions represented in the RG in a manner that is inconsistent with any issue finality

provisions in these part 52 licenses and regulatory approvals. If, in the future, the NRC staff seeks to impose a position in this RG in a manner that does not provide issue finality as described in the applicable issue finality provision, then the NRC staff must address the criteria for avoiding issue finality as described in the applicable issue finality provision.

Existing licensees and applicants of final design certification rules will not be required to comply with the positions set forth in this RG unless the licensee or design certification rule applicant seeks a voluntary change to its licensing basis with respect to the effects of light-water reactor coolant environments on the fatigue lives of nuclear power plant components by means of a cumulative usage factor, and where the NRC determines that the safety review of the licensee's request must include consideration of the effects of light-water reactor coolant environments on the fatigue lives of nuclear power plant components. Further information on the staff's use of the RG is contained in the RG under Section D, "Implementation."

Dated at Rockville, Maryland, this 30th day of May 2018.

For the Nuclear Regulatory Commission.

**Thomas H. Boyce,**

*Chief, Regulatory Guidance and Generic Issues Branch, Division of Engineering, Office of Nuclear Regulatory Research.*

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## **NUCLEAR REGULATORY COMMISSION**

[NRC-2014-0023]

### **Effect of LWR Water Environments on the Fatigue Life of Reactor Materials**

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** NUREG; issuance.

**SUMMARY:** The U.S. Nuclear Regulatory Commission (NRC) is issuing NUREG/CR-6909, Revision 1, "Effect of LWR Water Environments on the Fatigue Life of Reactor Materials." This report summarizes the results of NRC research efforts and work performed at Argonne National Laboratory on the fatigue of piping and pressure vessel steels in light-water reactor (LWR) environments. Revision 1 of this report provides updates and improvements to the environmental fatigue correction factor approach based on an extensive update to available laboratory fatigue data from testing and results available since this

report was first published in 2007. This final document also incorporates changes to address public comments provided on the draft of Revision 1 of NUREG/CR-6909.

**ADDRESSES:** Please refer to Docket ID NRC-2014-0023 when contacting the NRC about the availability of information regarding this document. You may obtain publicly-available information related to this document using any of the following methods:

- *Federal Rulemaking Website:* Go to <http://www.regulations.gov> and search for Docket ID NRC-2014-0023. Address questions about NRC dockets to Jennifer Borges; telephone: 301-287-9127; email: [Jennifer.Borges@nrc.gov](mailto:Jennifer.Borges@nrc.gov). For technical questions, contact the individuals listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.
- *NRC's Agencywide Documents Access and Management System (ADAMS):* You may obtain publicly-available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "ADAMS Public Documents" and then select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by email to [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov). The ADAMS accession number for each document referenced (if it is available in ADAMS) is provided the first time that it is mentioned in this document. Revision 1 of NUREG/CR-6909 is available in ADAMS under Accession No. ML16319A004.

- *NRC's PDR:* You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

**FOR FURTHER INFORMATION CONTACT:** Robert Tregoning, Office of Nuclear Regulatory Research, telephone: 301-415-2324, email: [Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov); or Appajosula Rao, Office of Nuclear Regulatory Research, telephone: 301-415-2381, email: [Appajosula.Rao@nrc.gov](mailto:Appajosula.Rao@nrc.gov), U.S. Nuclear Regulatory Commission, Washington DC 20555-0001.

**SUPPLEMENTARY INFORMATION:**

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (Code) provides rules for the design of Class 1 components of nuclear power plants. Appendix I to Section III of the Code contains fatigue design curves for applicable structural materials. However, the effects of LWR water environments are not explicitly

addressed by the Code design curves. The existing fatigue strain-vs.-life ( $\epsilon - N$ ) data illustrate potentially significant effects of LWR water environments on the fatigue resistance of pressure vessel and piping steels. Under certain environmental and loading conditions, fatigue lives in water relative to those in air can be significantly lower for austenitic stainless steels, nickel alloy materials, carbon steels, and low-alloy steels. In March 2007, Revision 0 of NUREG/CR-6909 (ADAMS Accession No. ML070660620) was issued. That report was the technical basis document for NRC Regulatory Guide (RG) 1.207, Revision 0, "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" (ADAMS Accession No. ML070380586). Revision 0 of NUREG/CR-6909 summarized the work performed at Argonne National Laboratory on the fatigue of piping and pressure vessel steels in LWR coolant environments. That report evaluated the existing laboratory fatigue data to identify the various materials, environmental, and loading parameters that influence fatigue crack initiation and summarized the effects of key parameters on the fatigue lives of pressure vessel and piping steels. The report presented models for estimating fatigue lives as a function of material, loading, and environmental conditions, and described the environmental fatigue correction factor for incorporating the effects of LWR coolant environments into Code fatigue evaluations.

Revision 1 of NUREG/CR-6909 provides updates and improvements to the environmental fatigue correction factor approach based on additional laboratory fatigue data and other results available since 2007. On April 17, 2014 (79 FR 21811), a draft of Revision 1 was noticed in the **Federal Register** for public comment under Docket ID NRC-2014-0023. The public comment period ended on June 2, 2014. The final version of Revision 1 of NUREG/CR-6909 reflects changes made to address the public comments. Appendix F of the document provides responses to the public comments received.

Revision 1 of NUREG/CR-6909 is the technical basis document for Revision 1 of RG 1.207, "Guidelines for Evaluating the Effects of Light-Water Reactor Water Environments in Fatigue Analyses of Metal Components" (ADAMS Accession No. ML16315A130). This RG describes methods and procedures that the NRC staff considers acceptable for use in determining the acceptable fatigue lives