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American Nuclear Society

WITHDRAWN

February 27, 2016

ANSI/ANS-57.5-1996 (R2006)

light water reactors fuel assembly mechanical design and evaluation

an American National Standard

This standard has been reviewed and reaffirmed with the recognition that it may reference other standards and documents that may have been superseded or withdrawn. The requirements of this document will be met by using the version of the standards and documents referenced herein. It is the responsibility of the user to review each of the references and to determine whether the use of the original references or more recent versions is appropriate for the facility. Variations from the standards and documents referenced in this standard should be evaluated and documented.
This standard does not necessarily reflect recent industry initiatives for risk informed decision-making or a graded approach to quality assurance. Users should consider the use of these industry initiatives in the application of this standard.

REAFFIRMED

February 28, 2006

ANSI/ANS-57.5-1996; R2006

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ERRATUM

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Light Water Reactors Fuel Assembly Mechanical Design and Evaluation

An error was identified in Section 5.4.1.3 on page 6. The preceding explanatory text is not consistent with the equation. Section 5.4.1.3 should read as follows:

5.4.1.3 For time-dependent effects, the summation of actual time (t) at a given stress level divided by the time of failure (t_f) at that stress level shall be less than 1.0. Also, the summation of creep strain incurred (ε^c) divided by the creep strain to failure

($\varepsilon^c{}_f$) shall be less than 1.0.

$$\sum \frac{t_i}{(t_f)_i} < 1.0 \quad \text{and} \quad \sum \frac{\varepsilon^c{}_i}{(\varepsilon^c{}_f)_i} < 1.0$$

American National Standard for Light Water Reactors Fuel Assembly Mechanical Design and Evaluation

Secretariat
American Nuclear Society

Prepared by the
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American National Standard

Designation of this document as an American National Standard attests that the principles of openness and due process have been followed in the approval procedure and that a consensus of those directly and materially affected by the standard has been achieved.

This standard was developed under the procedures of the Standards Committee of the American Nuclear Society; these procedures are accredited by the American National Standards Institute, Inc., as meeting the criteria for American National Standards. The consensus committee that approved the standard was balanced to ensure that competent, concerned, and varied interests have had an opportunity to participate.

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Comments on this standard are encouraged and should be sent to Society Headquarters.

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Foreword

(This Foreword is not a part of American National Standard for Light Water Reactors Fuel Assembly Mechanical Design and Evaluation, ANSI/ANS-57.5-1996.)

This American National Standard provides a procedure for determining the mechanical adequacy of fuel assembly designs for light water nuclear reactors. Specific requirements for design and specific rules for demonstrating compliance are also included.

It is not the intent of this standard to endorse any design feature, material, material property information, analysis method, or other procedure, or in any way to inhibit development or innovation in any of these areas. However, this standard does include certain requirements intended to ensure that the methods or material properties which are used are appropriate and adequately documented.

Suggestions for improvement of this standard are welcome. They should be sent to the American Nuclear Society, 555 North Kensington Avenue, La Grange Park, Illinois 60526.

The membership of Working Group ANS-57.5, at the time it submitted this revision of this standard, was as follows:

R. H. Ripley, Chairman, *Union Electric Company*
J. A. Nevshemal, *Raytheon UE&C*

The American Nuclear Society's Nuclear Power Plant Standards Committee (NUPPSCO) had the following membership at the time of its approval of the standard:

W.H. D'Ardenne, Chairman
M.D. Weber, Secretary

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(for the Institute of Electrical and Electronics Engineers, Inc.)
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C.D. Thomas, Jr. ..... Yankee Atomic Electric Company
G.P. Wagner ..... Commonwealth Edison Company
N. Weber ..... Consultant
G.J. Wrobel ..... Rochester Gas & Electric Corporation

Contents

Light Water Reactors Fuel Assembly Mechanical Design and Evaluation

1. Scope

This standard sets forth a series of design conditions and functional requirements for the design of fuel assemblies for light water cooled commercial power reactors. It includes specific requirements for design, as well as design criteria to ensure adequate fuel assembly performance. The standard establishes a procedure for performing an evaluation of the mechanical design of fuel assemblies. It does not address the various aspects of neutronic or thermal-hydraulic performance except where these factors impose loads or constraints on the mechanical design of the fuel assemblies.

2. Purpose

The purpose of this standard is to establish a set of design requirements for the mechanical design of initial core or reload fuel assemblies and for the evaluation of that design.

These design requirements include:

(1) A comprehensive set of functional requirements for fuel assemblies

(2) A method for selecting the specific events in each of the design conditions

(3) A comprehensive list of parameters, including material properties, chemical reactions, irradiation effects, and failure modes, which could affect the capability of fuel assemblies to satisfy one or more functional design requirements

(4) A method to achieve two goals: define which parameters and assumptions affect the capability of the fuel assembly to fulfill each functional requirement under each postulated event, and establish an appropriate limit for the defined parameters and assumptions which ensures that some aspect of a functional requirement for that event is met

(5) A procedure to document that the fuel assembly design has been evaluated in accordance with the design limits discussed in 5.4 (or similar) and has been shown to fulfill each functional requirement for each event.

3. Definitions

designer. The organization that has the responsibility for preparing the fuel assembly design.

design parameters. Material properties, dimensional characterizations, or physical response phenomena necessary to describe or evaluate fuel assembly behavior.

event. A describable situation that must be accounted for in design.

fuel assembly. The smallest modular unit comprised of individual fuel rods and associated integral component parts for handling, control, support, and maintenance of the unit's geometry. For boiling water reactors, the channel that encloses the fuel bundle and the channel fastener is included as part of the fuel assembly for design purposes.

functional requirement. One of several required capabilities of a fuel assembly that is necessary to meet its design function.

limit. A bounding value of a variable or parameter, which is established to ensure that one or more aspects of a functional requirement are satisfied.

margin. A quantitative relationship between a design evaluation result for a given event and a limit associated with a functional requirement.

shall, should, and may. The word "shall" denotes a requirement; the word "should" denotes a recommendation; and the word "may" denotes permission, neither a requirement nor a recommendation.

4. Compliance

Design documentation shall be prepared to show how the criteria and requirements of this standard are satisfied. Provisions for dissemination of