American Nuclear Society

WITHDRAWN
November 14, 2004
ANSI/ANS-15.10-1994

decommissioning of research reactors

an American National Standard

No longer being maintained as an American National Standard. This standard may contain outdated material or may have been superseded by another standard. Please contact the ANS Standards Administrator for details.

published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA

ANSI/ANS-15.10-1994

American National Standard for Decommissioning of Research Reactors

Secretariat
American Nuclear Society

Prepared by the
American Nuclear Society
Standards Committee
Working Group ANS-15.10

Published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA

Approved November 14, 1994
by the
American National Standards Institute, Inc.

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 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.

An American National Standard is intended to aid industry, consumers, governmental agencies, and general interest groups. Its use is entirely voluntary. The existence of an American National Standard, in and of itself, does not preclude anyone from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard.

By publication of this standard, the American Nuclear Society does not insure anyone utilizing the standard against liability allegedly arising from or after its use. The content of this standard reflects acceptable practice at the time of its approval and publication. Changes, if any, occurring through developments in the state of the art, may be considered at the time that the standard is subjected to periodic review. It may be reaffirmed, revised, or withdrawn at any time in accordance with established procedures. Users of this standard are cautioned to determine the validity of copies in their possession and to establish that they are of the latest issue.

The American Nuclear Society accepts no responsibility for interpretations of this standard made by any individual or by any ad hoc group of individuals. Requests for interpretation should be sent to the Standards Department at Society Headquarters. Action will be taken to provide appropriate response in accordance with established procedures that ensure consensus on the interpretation.

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

Published by

American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA

Printed in the United States of America

Foreword

(This Foreword is not a part of American National Standard for Decommissioning of Research Reactors, ANSI/ANS-15.10-1994, but is included to provide a background and explain the need for non-power reactor standards and criteria concerning the use of those standards.)

The American Nuclear Society Standards Secretariat established Subcommittee ANS-15 in the fall of 1970 with the task of preparing a standard for the operation of research reactors. In January 1972, this charter was expanded to the multiple tasks of preparing all standards for research reactors. To implement this enlarged responsibility, several subcommittee working groups were established to develop standards for consideration, and complementary action by Subcommittee ANS-15. ANS-15.10 is one of these groups.

In March 1979, Working Group ANS-15.10 was assigned the task of developing a draft standard for decommissioning of research reactors. Since that time changes in regulatory policy were incorporated into this current revision.

Present decommissioning regulations for reactors are contained in Title 10, "Energy," Code of Federal Regulations, Part 50, "Licensing of Production and Utilization Facilities," which addresses primarily the financial qualifications of the applicants. The policy for licensed power reactors is contained in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," which was issued in June 1974 and is generally used as a basis for decommissioning activity. Currently, the NRC is in the process of developing more specific criteria through an enhanced participatory rulemaking process designed to establish radiological criteria for the decommissioning of NRC-licensed facilities. Section 5 in general and Table 5.2 in particular are presented as the best available criteria that are reasonable and acceptable, but subject to change as further focused analysis is completed. This standard provides needed procedures, criteria, and standardization for the decommissioning of research reactors; the standard which is also appropriate for test reactors.

As a caution, because of the current developmental activity by the NRC in this area, it should be recognized that some of the procedures and criteria stated in this standard are not based on existing regulations, and that as regulations are developed and approved, such procedures and criteria may be subject to change.

In preparing this standard, the intent has been to specify objectives that will:

(a) Assist in implementing regulatory requirements.
(b) Be a significant aid in planning and executing decommissioning activities.

The family of American National Standards developed by ANS-15 for research reactors includes the following:

ANSI/ANS-15.1-1990, American National Standard for the Development of Technical Specifications for Research Reactors

ANSI/ANS-15.2-1990, American National Standard for Quality Control for Plate-Type Uranium-Aluminum Fuel Elements

ANSI/ANS-15.4-1988, American National Standard for Selection and Training of Personnel for Research Reactors

ANSI/ANS-15.7-1977 (R1986), American National Standard for Research Reactor Site Evaluation

ANSI/ANS-15.8-1976 (R1986), American National Standard for Quality Assurance Program Requirements for Research Reactors

ANSI/ANS-15.11-1993, American National Standard for Radiation Protection at Research Reactor Facilities

ANSI/ANS-15.15-1978 (R1986), American National Standard Criteria for the Reactor Safety Systems of Research Reactors

ANSI/ANS-15.16 (R1988), American National Standard for Emergency Planning for Research Reactors

ANSI/ANS-15.17 (R1987), American National Standard Fire Protection Program Criteria for Research Reactors

ANSI/ANS-15.19-1991, American National Standard for Shipment and Receipt of Special Nuclear Material (SNM) by Research Reactor Facilities

The ANS-15.10 Working Group membership at the time of completion of the standard was:

M. H. Voth, Chairman, *Pennsylvania State University*
J. J. Adler, *TLG Engineering, Inc.*
W. E. Austin, *Westinghouse Electric Corporation*
J. A. Christian, *Chem-Nuclear Environmental Services, Inc.*
T. S. LaGuardia, *TLG Engineering, Inc.*
M. Mendonca, *U.S. Nuclear Regulatory Commission*
T. R. Schmidt, *Sandia National Laboratory*

The membership of Subcommittee ANS-15 at the time of its approval of this standard was:

W. J. Richards, Chairman,
U. S. Department of Defense
A. Adams Jr., *U.S. Nuclear Regulatory Commission*
T. L. Bauer, *University of Texas*
S. K. Bhatnager, *U. S. Department of Energy*
W. J. Brynda, *Brookhaven National Laboratory*
B. L. Corbett, *Oak Ridge National Laboratory*
J. P. Farrar, *University of Virginia*
M. L. Gilder, *Oak Ridge National Laboratory*
D. E. Hughes, *Pennsylvania State University*
R. C. Nelson, *EG&G Idaho*
D. P. Pruett, *Argonne National Laboratory-West*
T. M. Raby, *National Institute of Standards and Technology*
J. Razvi, *General Atomics*
T. R. Schmidt, *Sandia National Laboratory*
M. H. Voth, *Pennsylvania State Univeraity*
R. R. Walston, *U. S. Department of Energy*

Consensus Committee N17, Research Reactors, Reactor Physics, Radiation Shielding, and Computational Methods, had the following membership at the time it reviewed and approved this standard:

T.M. Raby, Chairman
A. Weitzberg, Vice-Chairman

J. D. Buchanan ..... Individual
A. D. Callihan ..... Individual
R. E. Carter ..... Individual
D. Cokinos ..... Brookhaven National Laboratory
A. De La Paz ..... Vista Technology
D. Duffey ..... American Institute of Chemical Engineers
H. Goldstein ..... American Physical Society
S. Hartzell ..... Power Computing Company
P. B. Hemming ..... U. S. Department of Energy
J. W. Lewellen (Alt.)
W. A. Holt ..... American Public Health Association
W. C. Hopkins ..... Bechtel Corporation
J. E. Hyder ..... Health Physics Society
A. G. Johnson (Alt.)
L. I. Kopp ..... Individual
J. Miller ..... Institute of Electrical and Electronics Engineers, Inc.
J. E. Oelhoeft ..... Individual
T. M. Raby ..... American Nuclear Society
W. J. Richards ..... U.S. Department of Defense
M. M. Ter Pogossian ..... American College of Radiology
J. F. Torrence ..... National Institute of Standards and Technology
D. K. Trubey ..... Individual
S. H. Weiss ..... U.S. Nuclear Regulatory Commission
A. Adams Jr. (Alt.)
A. Weitzberg ..... Halliburton NUS Corporation
W. L. Whittemore ..... GA Technoliogies, Inc.

Contents

Decommissioning of Research Reactors

1. Scope

This standard provides requirements and criteria for the decommissioning of research reactors and includes decommissioning alternatives, planning, radiation criteria, surveillance and maintenance, environmental impacts, quality assurance, and reports and documentation.

2. Definitions

as low as is reasonably achievable (ALARA). To make every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, consistent with the purpose for which the permitted or licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of nuclear energy and permitted or licensed materials in the public interest.

decommissioning. The measures taken at the end of the reactor facility's life to remove radioactive material to acceptable levels so as to terminate the license or operating authorization. For the scope of this standard, only the special nuclear, source, and byproduct materials are covered. All other hazardous substances should be handled in accordance with standard industry procedures, guidelines, or requirements.

non-power reactor (NPR). See research reactor.

research reactor. A device designed to support a self-sustaining neutron chain reaction for research, developmental, educational, training, or experimental purposes, and that can have provision for production of radioisotopes.

NOTE: For the purposes of this standard, test and non-power reactors fall within this definition.

research reactor facility. All areas within which the owner or operator directs authorized activities associated with the reactor.

shall, should, and may. The word "shall" is used to denote a requirement; the word "should" to denote a recommendation; and the word "may" to denote permission, neither a requirement nor a recommendation.

test reactor. See research reactor.

unrestricted use. The use of a facility, material, equipment, or waste when the radioactive content on surfaces of or inherent within any portion of it is sufficiently low to pose no unacceptable health hazard to any individual or group of individuals regardless of any future use or location of the facility, material, equipment, or waste.[1]

3. Decommissioning Alternatives

The ultimate abandonment of a reactor facility upon completion of operations will require either (1) the retention of certain radioactive materials *in situ*, or (2) the removal of radioactive materials to acceptable levels from the facility to an approved disposal site. Retention of materials *in situ* will require continuation of a license or charter and does not complete a decommissioning alternative. Three major recognized decommissioning alternatives leading to the ultimate disposition are interim mothballing, in-place entombment, and removal of radioactive components and dismantling;[2] see *Decommissioning Handbook* [1].[3] The acronyms SAFSTOR, ENTOMB, and DECON are

---

[1] Unrestricted use addresses only health hazards and not potential industrial uses which might be impacted by low radioactivity, e.g., sensitive radiation detectors.

[2] See Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors" (June 1974). Regulatory guides are available from the U.S. Nuclear Regulatory Commission, Washington, DC 20555.

[3] Numbers in brackets refer to corresponding numbers in Section 10, References.