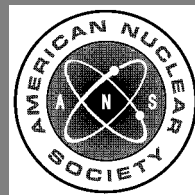


American Nuclear Society

**format and content for safety analysis
reports for research reactors**

an American National Standard



published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60526 USA

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ANSI/ANS-15.21-2012

**American National Standard
Format and Content for
Safety Analysis Reports for Research Reactors**

Secretariat
American Nuclear Society

Prepared by the
**American Nuclear Society
Standards Committee
Working Group ANS-15.21**

Published by the
**American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60526 USA**

Approved April 3, 2013
by the
American National Standards Institute, Inc.

American National Standard

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- (3) the purpose(s) of the inquiry;
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- (5) a proposed reply, if the inquirer is in a position to offer one.

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Foreword (This Foreword is not a part of American National Standard “Format and Content for Safety Analysis Reports for Research Reactors,” ANSI/ANS-15.21-2012.)

The American Nuclear Society (ANS) Standards Committee 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 include the task of preparing standards for all aspects of research reactor needs. To implement this enlarged responsibility, Subcommittee ANS-15 established a number of working groups to develop standards for consideration and complementary action. This standard addresses itself to the format and content of safety analysis reports (SARs) for research reactors.

Working Group ANS-15.21 was formed in 1991 to develop ideas and concepts leading to a standard for guidance on the format and content of a research reactor SAR, taking into account available guidance and recognizing that many research reactor SARs have successfully presented descriptive and analytical information through the use of a simple format and limited content.

This standard recognizes the merits of the historical guidance (Regulatory Guide 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants”), the work by the U.S. Nuclear Regulatory Commission on guidance for nonpower reactors (NUREG-1537, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors”), the work of the U.S. Department of Energy (Order 5480.23, “Nuclear Safety Analysis Reports”), and the International Atomic Energy Agency work that encompasses safety analysis documentation (Safety Series 35).

It is recognized that a power station has huge and variable sources of stored energy, dedication to highly reliable on-line power, massive containment and energy control features, and extremely harsh equipment operating environments. Research reactors, on the other hand, are small, noninvasive facilities with low fission product inventories, minimal stored energy, and simple equipment environments, resulting in small risk compared to nuclear power plants. This standard recognizes the considerably reduced risks, markedly simpler systems, and unique mission of research reactors. A graded approach to content, level of description, and level of analysis is thus very important. It is recognized that it is neither necessary nor possible to apply the same degree of description or analysis for all systems or events. Where this standard uses terms such as “appropriate” or “as necessary,” these are to be interpreted as meaning such variation in the degree of description and analysis.

Nuclear critical assemblies (facilities operating in the context of ANSI/ANS-1-2000 (R2012), “Conduct of Critical Experiments”) often have flexible cores and generally do not have coolant systems, fission product inventories, radioactive waste streams, or confinement systems. Therefore, many of the requirements of this standard are not appropriate for nuclear critical assembly facilities, and it is beyond the scope of the working group to include alternative guidance.

Since the standard provides guidance on how facility descriptive information is presented and does not introduce new criteria for any aspect of design, construction, or operation, a very limited definition section is included.

SARs are used extensively by analysts, operations staff, review groups, and licensing and chartering agencies in support of the research reactors’ unique mission. The SAR provides the central repository of information used for performing analysis, determining bounding conditions, and establishing the foundation of technical specifications.

In this process of creating standards against the background of established and varied practices in many operating facilities, it is important to consider the following:

- (1) It is not intended that the standard be used as a demand model for backfitting purposes;
- (2) The standard should be a vital aid for the new owner-agency;
- (3) The standard should be helpful for the facility undergoing change or modification;
- (4) Thoughtful use of the standard by the industry should ease the burden of licensing and chartering agencies.

It is affirmed further that the use of any standard of performance, conduct, or excellence is volitional. The decision to use a standard is a management matter, presumably based on technical advisement.

Guidance may be found in the following supplementary American National Standards developed for research reactors:

ANSI/ANS-15.1-2007, "The Development of Technical Specifications for Research Reactors";

ANSI/ANS-15.2-1999 (R2009), "Quality Control for Plate-Type Uranium-Aluminum Fuel Elements";

ANSI/ANS-15.4-2007, "Selection and Training of Personnel for Research Reactors";

ANSI/ANS-15.7-1977 (R1986) (withdrawn), "Research Reactor Site Evaluation";

ANSI/ANS-15.8-1995 (R2005), "Quality Assurance Program Requirements for Research Reactors";

ANSI/ANS-15.10-1994 (withdrawn), "Decommissioning of Research Reactors";

ANSI/ANS-15.11-2009, "Radiation Protection at Research Reactor Facilities";

ANSI/ANS-15.15-1978 (R1986) (withdrawn), "Criteria for the Reactor Safety Systems of Research Reactors";

ANSI/ANS-15.16-2008, "Emergency Planning for Research Reactors";

ANSI/ANS-15.17-1981 (R2000) (withdrawn), "Fire Protection Program Criteria for Research Reactors";

ANSI/ANS-15.19-1991 (withdrawn), "Shipment and Receipt of Special Nuclear Material by Research Reactor Facilities."

This standard might reference documents and other standards that have been superseded or withdrawn at the time the standard is applied. A statement has been included in the references section that provides guidance on the use of references.

This standard does not incorporate the concepts of generating risk-informed insights, performance-based requirements, or a graded approach to quality assurance. The user is advised that one or more of these techniques could enhance the application of this standard.

The working group included a broad spectrum of expertise in research reactor operations, experiment and reactor analysis, SARs, and interactions with chartering and licensing agencies. The members represent a wide variety of research reactors—including those at universities, national laboratories, and government

facilities—and participation in international standards work. Working Group ANS-15.21 of the ANS Standards Committee had the following membership:

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S. Reese, *Oregon State University*

C. Stanley, *Idaho National Laboratory*

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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:

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A. Weitzberg (Vice Chair), *Individual*

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Format and Content for Safety Analysis Reports for Research Reactors

1 Introduction

1.1 Scope

This standard provides the criteria for the format and content for safety analysis reports (SARs) for research reactors.

1.2 Definitions

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

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

1.3 Application

1.3.1 Purpose

Research reactors require safety analysis and documentation showing that they are safe to operate for their allowed envelope of operation and in combination with experiments that may be placed in or around them. This standard identifies specific information and analyses for inclusion in the SAR and establishes a uniform format for the SAR. Adherence to this standard will ensure completeness of the information and maximize its usefulness to research reactor staffs, support personnel, and oversight groups for current and future information needs. Sufficient detail is incorporated so that a preparer can understand the desired composition, and the technical elements, of the SAR.

Because of the special nature and diversity of research reactors, which reflect design features and operational characteristics chosen to allow the pursuit of unique missions, no general standard can be applied to research reactors without thoughtful interpretation. Therefore, the applicability of any criterion specified in this standard might range from total to nil, depending on the research reactor.

1.3.2 Format

In order to assure that all major topics that might be relevant for inclusion in the SAR have been considered, a part of the requirements of this standard is the title and numbering of each chapter as described in Sec. 2. The applicable topics in each chapter shall include the following information to the extent appropriate: introductory information, descriptive information, analysis, and relevant conclusions. Where process variable limits are described in the text, the limit should be identified, as appropriate, if it is the technical basis of a specification in governance documents. Departure from the detailed contents within a given chapter is allowed in order to meet the specifics of a given facility. Departure from chapter titles and numbering shall be avoided by using statements such as “not applicable” when a chapter does not apply. Additional numbered chapters may be added as necessary for other major topics (for example, Financial Qualifications, Highly Enriched Uranium to Low-Enriched Uranium Conversions, etc.).¹⁾

1.3.3 Style

The reactor SAR shall be printed for ease of use and for updates and page change-outs. The following criteria should be used:

¹⁾Appendix A provides a representative “Table of Contents for a Research Reactor Safety Analysis Report” and suggests a desired format. Appendix B provides a list of “Selected Initiating Events for Research Reactor Accident Analysis” that may be useful in performing accident analyses for the SAR. Appendix C provides a list of “References Related to Research Reactor Safety Analysis Reports.”