ANS Standards Style Manual

ANS 2025 Standards Style Manual

2nd Edition

American Nuclear Society

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Foreword

The American Nuclear Society (ANS) Standards Committee has been active in the development of industry standards since 1957. All ANS standards receive dual approval from the American National Standards Institute (ANSI) and are thus considered American National Standards. Industry standards are often started to establish safe practices. Once a standard is written and approved, it may influence regulatory guidance. Further, standards developed under voluntary consensus procedures, like those of ANS, often receive wide acceptance in their industry because of the broad representation of experts who worked to create the standard.

An ANS working group is the writing committee. These groups, which consist of from 2 to 20 people (usually about 12 people), create the text of ANS standards. A standard can take from 2 to 20 years (usually about 6 years) to write. Each standard goes through numerous revisions.

Clearly, when a standard reaches the copy editor's desk, it is the product of an enormous amount of work on the part of many experts over a long period of time, and it has been approved by ANSI. Consequently, the copy editing of a standard must be enormously judicious, but this does not mean that the copy editor does very little to a standard. In fact, the copy editing of a standard can be very extensive.

Since many people write a standard, there are likely to be different writing styles. These styles must be made consistent. Moreover, with the number of revisions that a standard goes through, certain parts of a standard may have been changed, but others were not; the copy editor must check for consistency throughout a standard.

The first edition of the ANS Style Manual issued for trial use incorporated guidance from the 1991 "Style Manual for Preparation of Proposed American National Standards" developed by ANSI that remained valid and included format and style criteria specific for ANS standards. The 2nd edition of the ANS Style Manual, this version, issued 202x includes a minor format and style refresh. The purpose of this style manual is to provide the necessary information needed to prepare American National Standards that are to be published by the ANS. It provides detailed specifications regarding content, format, and style as well as detailed descriptions of ANS policies relating to ANS standards and their publication. The manual's requirements, which are applied by the ANS Publications Department in preparing standards for publication, are intended to ensure that a standard is clearly written and that it is consistent in style and presentation within itself and with other ANS-published standards and documents.

Anyone who is involved in any aspect of draft development or preparation of ANS standards for publication will benefit from the information provided in this manual.

Secs. 1 through 10 contain written specifications regarding content, style, publication procedures, and ANS policies. An appendix provides sample standard elements that illustrate the written specifications.

Questions regarding the criteria provided in this manual or for help in formatting an ANS standard should be directed to standards@ans.org.

Contents

Appendix

ANS Standards Style Manual

1 Scope, purpose, and application

1.1 Scope

This style manual establishes format and style guidelines for the preparation of American National Standards that are to be published by the American Nuclear Society (ANS).

1.2 Purpose

By preparing draft standards according to specifications contained in this manual, working groups can help accelerate and streamline the ANS Standards publishing process, reducing the time required between American National Standards Institute (ANSI) approval and public availability of the standard.

The manual also seeks to make ANS standards publications more consistent in terms of style, formatting, organization, and application of best practices for presentation of content. For ANS, such consistency improves “brand” recognition and quality. For the reader, consistency in and effectiveness of content presentation facilitates understanding and application of standards and reduces the likelihood of confusion and misinterpretation.

1.3 Application

Draft standards shall be provided to ANS in Microsoft Word. Figures, images, graphics, tables, etc., shall be provided in original format and/or high resolution appropriate for publication. ANS staff will review and apply formatting style prior to subcommittee ballot as needed. At that time, ANS staff shall request the working group chair to complete a disclosure form identifying any third-party material used in the draft standard so that copyright permission can be secured by ANS. Editing will not be initiated without submittal of a signed disclosure form (see C3, Policy on Handling References and Excerpts in Standards, in the ANS Standards Committee Policy Manual). A template providing a generic format for drafting ANS standards is available in the Toolkit for ANS Standards Development and Maintenance or upon request by contacting standards@ans.org.

2 Editorial responsibilities and policies

While spell checkers are useful for identifying typographical and grammatical errors, technical contacts should proofread all documents manually.

2.1 Technical contact's responsibility

Working groups shall be responsible for providing ANS with complete and technically accurate drafts that meet the requirements of this style manual for content, arrangement, and that conform to ANS's policies and procedures. Particularly important is conformance with the requirements for abbreviations, letter and unit symbols, the numbering system, and the style for special elements. However, volunteers who develop standards shall not be expected to be grammarians or professional editors. ANS’s editor shall review the text before publication and make necessary editorial changes. Editorial changes shall be made with the concurrence of the technical contact, typically the working group chair unless an alternate is appointed.

The technical contact should be available to answer questions via email or phone with ANS's editor as needed.

Final page proofs of American National Standards shall be approved by the technical contact prior to releasing the document for publication.

2.2 Role of the ANS Publications Department

ANS's Publications Department shall participate in and oversee the publication of draft standards in print and electronic format. The functions performed by the department and its overall responsibilities are described in Secs. 2.3 through 2.6.

The department also provides guidance and support on style and format to working group chairs upon request.

2.3 Responsibility of ANS's editor with regard to the technical contact

All phases of standards production shall be facilitated by the ANS standards manager. Communication regarding a given standard shall take place between the technical contact and the ANS standards manager and may include the ANS editor.

The technical contact and ANS's editor shall be jointly responsible for proofreading the material and ensuring that it is published without any typographical or editorial errors. Before sending the document to ANS, the technical contact shall proofread all material and shall correct all typographical errors that are found.

2.4. Policy on editorial and substantive changes

2.4.1 Substantive change defined

A substantive change in a proposed American National Standard is one that directly and materially affects the use of the standard. Examples of substantive changes follow:

- changing "shall" to "should" or "should" to "shall" (see Sec. 7.8.1);
- addition, deletion, or revision of requirements, regardless of number of changes;
- addition of mandatory compliance with referenced standards.

2.4.2 Policy

ANS's editors will correct grammatical errors and inconsistencies and will also ensure that the standard conforms to the content and style requirements detailed in this style manual. Changes made by ANS's editor will be provided to the technical contact for review, but this review does not imply that the technical contact may initiate text changes. The role of the technical contact during the review is to acknowledge that the editorial "cleaning up" has not changed the technical content of the standard.

The draft standard from the final ballot with technical and editorial changes made in the document during the approval process is the text which ANS prepares for publication. This process includes ANSI's public review and comment procedures. These changes were voted on and accepted for inclusion.

Occasionally, a query or comment made by ANS's editor may bring to light a technical error that had not been previously discussed or realized by the consensus committee. In such a case, the consensus committee chair, subcommittee chair, and working group chair shall determine if the change is substantive requiring withdrawal of the standard to gain consensus committee approval and permit public review of the substantive change.

2.5 Editorial functions

Upon receipt of the document, ANS's editor shall proofread the document and, where necessary, make corrections to:

- spelling, punctuation, hyphenation, grammar;
- abbreviations, letter and unit symbols, and drafting practices that do not conform to applicable American National Standards;
- numbering system, if it does not conform to this style manual;
- references to other American National Standards, if they are incomplete or erroneous;
- errors in style, as detailed in this style manual.

The editor also reads the standard for sense, clarity of language, and reviews overall organization.

2.6 Final check

The ANS editor shall check the proof to ensure that:

- entries in the Table of Contents correspond to the text;
- page sequence and running heads are correct;

3 Definitions

This section provides definitions for terms used in this style manual. These terms relate to style, content, and policy.

em: Traditionally the horizontal distance taken up by the capital letter "M." Most commonly used to describe the length of hyphens and spaces.

en: One-half of an em. Most commonly used to describe the length of hyphens and spaces.

landscape: Refers to the horizontal orientation of a page, table, or figure. A landscape page is sometimes referred to as a "turn" page.

pagination: The arrangement of document page. One of the final steps in the preparation for publication.

points: Typesetting unit of measurement, used principally for designating type or font sizes.

portrait: Refers to the vertical orientation page, table, or figure.

running heads: A continuing element placed at the top of each page of a document, usually identifying the document.

secretariat: Performs all administrative functions as required by the Procedures for the Development and Coordination of American National Standards.

sister standards: Two or more American National Standards that deal with the same project or subject. Each individual standard provides requirements and recommendations tor different aspects of the project or subject.

superscripts and subscripts: Characters or strings of characters that directly precede or follow a word and which have baselines that are shifted up (superscript) or down (subscript) relative to that word.

technical contact: The working group chair or an alternate appointed to act as the liaison between the technical committee and ANS Publication Department.

4 Format, style, and structure for specific standard elements

This section the format, style, and structure for each major element of a standard. Uniformity of structure, of style, and of terminology shall be maintained not only within each standard, but also within a series of sister standards. Working groups are required to consult the ANS Glossary of Terms in the Toolkit for ANS Standards Development and Maintenance to ensure consistency. The structure of sister standards and the numbering of their sections shall, as far as possible, be identical. Analogous wording shall be used to express identical provisions.

These requirements are particularly important not only to ensure comprehension of the standard but to ensure harmonization within the collection of ANS standards.

4.1 Elements of a published standard

The following elements shall be included in the final drafts of proposed American National Standards (exceptions are noted):

- cover; (ANS to insert)
- title page; (See page 34 for an example)
- copyright page; (see page 35 for an example)
- inquiry page; (see page 36 for an example)
- foreword which includes the consensus committee roster, subcommittee roster, and working group roster (see page 37- 38 for an example)
- table of contents; (see page 39 for an example)
- main text (body of standard), including (see page 40 - 51):
  - introduction (optional);
  - scope, purpose, and application;

- acronyms and definitions (as applicable);
- requirements;
- tables, if any;
- figures, if any;
- references; (see page 15 for examples)

- appendices, if any; (includes bibliography) (see pages 17 and 52 for examples)

The cover, title page, copyright page, and inquiry page are supplied by ANS.

4.2 General style

A margin of 1" for all sides with a .5" margin for headers and footers should be applied to the full document. Except for the title page, every page of the standard should include the header "American National Standard ANSI/ANS-X.X-202x" flushed right/left for odd/even pages. The appendix provides illustrated examples of the ANS format and style as a complement to the written specifications.

4.3 Capitalization

Only the first letter of the first word of each listing shall be capitalized, which is the style used for headings in the main text and for table and figure titles.

Acronyms and abbreviations that are written in capital letters in normal usage shall also remain capitalized in titles.

4.4 Page layout and fonts

ANS staff will add the title page, copyright page, inquiry page, and lastly cover to ANS standards and will provide formatting assistance for the balance of the standard upon request. The specifications for formatting each section of the standard are provided for reference.

4.4.1 Cover (provided by ANS)

- Designation flush top right in Arial Narrow 14 point bold font
- ANS logo
- Title flush left in Arial Narrow 24 point bold font
- The words "An American National Standard" in Trade Gothic LT Std 20 point bold font
- The publisher name flushed right at the bottom margin in Trade Gothic LT Std 11 point bold font
- Designation placed vertically at left margin in Arial Narrow 14 point bold font

4.4.2 Title page (provided by ANS – see page 34 for an example)

- Designation in Arial 12 point bold font
- American National Standard and title in Arial 15 point bold font

- Secretariat information in Times New Roman 12 point font; 2nd line bold
- Working group information in Times New Roman 12 point font; 2nd through 4th line bold
- Publisher information in Times New Roman 12 point font; 2nd line bold
- Approval information Times New Roman 12 point font; 3rd line bold
- No header
- Unnumbered page

4.4.3 Copyright page (provided by ANS – see page 35 for an example)

- Two-column table
  - Left column at 1.1" width
  - Right column at 5.55" width
- 14 point Arial bold font for the words “American National Standard” in the left column
- 10.5 point Times New Roman font for the body of foreword in the right column
- Text defining an American National Standard
- Text full (right/left) justified in the right column
- Block style
- Double space between paragraphs (no paragraph indent)
- The phrase “Published by” in Times New Roman 11 point font followed by 20 point space
- Publisher information in Times New Roman 11 point bold font
- Warning graphic
- Copyright statement; 1st line in Times New Roman 11 point bold font; 2nd line in Times New Roman 11 point font
- Reproduction disclaimer in Times New Roman 11 point font
- The phrase “Printed in the United States of America” in Times New Roman 11 point font
- Header “American National Standard ANSI/ANS-X.X-202x” in Times New Roman 9 point font
- Unnumbered page

4.4.4 Inquiry page (provided by ANS – see page 36 for an example)

- Two-column table
  - Left column at 1.1" width
  - Right column at 5.55" width
- 14 point Arial bold font for the words “Inquiry Request” and “Inquiry Format” in the left column
- 10.5 point Times New Roman font for inquiry text in the right column

- Text full (right/left) justified in the right column
- Block style
- Double space between paragraphs (no paragraph indent)
- Header “American National Standard ANSI/ANS-X.X-202x” in Times New Roman 9 point font
- Unnumbered page

4.4.5 Foreword (see page 37 for an example)

- Two-column table
  - Left column at 1.1" width
  - Right column at 5.55" width
- 14 point Arial bold font for the word “Foreword” in the left column
- 9 point Times New Roman font for the disclaimer in the right column
- 10.5 point Times New Roman font for the body of foreword in the right column
- Text full (right/left) justified in the right column
- Block style
- Double space between paragraphs (no paragraph indent)
- Header “American National Standard ANSI/ANS-X.X-202x” in Times New Roman 9 point font
- Page numbered “i” and centered in footer in Times New Roman 10 point font

4.4.6 Table of contents (see page 39 for an example)

- Single column
- 14 point Arial bold font for the word “Contents” at the left margin with 20 point spacing after
- 14 point Times New Roman bold font for the words “Section” at .81 indent from left margin and the word “Page” at the right margin
- 20 point space before the body of the table of contents
- 10.5 point Times New Roman font for the body of the table of contents
- Bold section numbers (not titles or subsections)
- 6 point space between each section
- List figures and then tables from the body of the standard following the section titles
- 20 point space before the list of figures and/or tables
- 12 point Times New Roman bold font for the word “Figures” and/or “Table at .81 indent from left margin

- 10.5 point Times New Roman font for list of figures and/or tables
- 20 point space before the list of appendices
- 12 point Times New Roman bold font for the word “Appendices,” “Tables,” and “Figures” at .81 indent from left margin
- 10.5 point Times New Roman font for list of appendices (table and figures in appendices not included in table of contents)

4.4.7 Main text (body of the standard – see pages 40 – 51 for examples)

- Single column
- Block style with text full (right/left) justified
- Double space between headings and paragraphs (no paragraph intent)
- Pages numbered consecutively starting with number “1” in the footer
- Page numbers flushed right/left for odd/even numbered pages
- Times New Roman font
  - 28 point bold font for title on page 1
  - 20 point space after title of standard/before section heading
  - 14 point bold font for section headings (e.g., Sec. 1, Sec. 2, Sec. 3)
  - 11 point space after section headings/before section
  - 11 point bold font for subsection headings (e.g., Secs. 2.1, 2.1.1, 2.1.2, 2.2.1.1)
  - 11 point font for body of standard
  - 11 point font for notes part of main text
  - 10 point font page numbers
  - 9 point font for headers
  - 9 point font for footnotes

4.4.8 Appendices (see page 17 and 52 for examples)

- Single column
- Text full (right/left) justified
- Double space between headings and paragraphs (no paragraph intent)
- Times New Roman font
  - 26 point bold font for letter of appendix (e.g., Appendix X)
  - 20 point space after appendix title
  - 9 point font for the disclaimer
  - 20 point space after the disclaimer
  - 14 point bold font for the title

- 14 point bold font for section headings
- 11 point font for body of appendix
- 11 point bold font for figure and table titles
- 10 point font for text in tables
- 10 point font page numbers
- 9 point font for headers
- 9 point font for footnotes

4.4.9 Tables and figures (see pages 46 – 50 for examples)

- Times New Roman font
  - 11 point bold font for figure and table titles
  - 10.5 point font for text in tables but may be reduced as low as 8 pt. if necessary
  - 10 point font size for table notes

5 Contents of standards elements

5.1 Foreword (see page 37 for an example)

A foreword shall be used in a standard only for purposes of clarification, illustration, and general information in respect to the standard. Its relationship to the standard shall be set forth clearly. A foreword shall be within the scope of the project under which the standard was developed and promulgated, and it shall not be inconsistent with the standard itself. A statement to the effect that the material is informative and does not contain any requirements of American National Standard shall appear at the beginning of any foreword. Mandatory (shall) requirements are rightfully a part of a standard and shall not be placed in a foreword.

The working group shall prepare a foreword. A good foreword will greatly enhance the value of the standard.

- a description of the standard's purpose and major provisions;
- information as to who will benefit from application of the standard and what problems it will solve;
- an explanation of the principal differences between current and earlier editions;
- a short history of the standard's development;
- recognition of appendices (if applicable);
- boilerplate statements on references and use of risk-informed and/or performance-based requirements;
- a disclaimer that the foreword is provided for informational purposes.

5.1.1 Required statements

The following disclaimer shall appear above the text:

(This foreword does not contain any requirements of American National Standard ANSI/ANS-X-XX-202x, *[Title]*, but is included for informational purposes.)

The following statement shall be included in the foreword of all new, revised, or reaffirmed standards.

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.

The foreword shall include one of the following three statements (See Sec. 9.3 of the ANS Standards Committee Procedures Manual for Consensus Committees in the Toolkit for ANS Standards Development and Maintenance)

- *The working group has incorporated risk-informed and/or performance-based requirements in this standard.*
- *The working group has determined that the incorporation of risk-informed and/or performance-based requirements in this standard may be worthwhile and intends to consider this in a future revision.*
- *The working group has determined that this standard does not benefit from inclusion of risk-informed and/or performance-based requirements.*

5.1.2 Committee rosters (see pages 37 – 38 for examples)

The informative portion of the foreword shall be followed by the working group roster, the subcommittee roster (if applicable), and then the consensus committee roster. Each roster shall list officers first followed by members in alphabetical order providing company affiliations for all as applicable.

The working group chair is responsible for adding the working group roster. The working group roster shall recognize all individuals that made a contribution to the standard at any point within its development. Working group members may be recognized on the roster posthumously but shall include "(posthumously)" following their company affiliation. If deemed appropriate, a statement may be prepared by the working group to recognize the significant contribution of the deceased member for inclusion in the paragraph preceding the roster.

The ANS standards staff is responsible for adding the subcommittee and consensus committee rosters. Subcommittee and consensus committee rosters shall be consistent with the membership and their company affiliation at the time the respective ballots were issued. All rosters should recognize observers, liaisons, alternates, and associate members when applicable. A sample format is provided below:

This standard was prepared by the ANS-XX.XX Working Group of the American Nuclear Society. The following members contributed to this standard (this statement may be modified by the working group):

F. M. Last (Chair), *Organization*
F. M. Last (Vice Chair), *Organization*

F. M. Last, *Organization*
F. M. Last, *Organization*

The [Title of Subcommittee] had the following membership at the time of its approval of this standard:

F. M. Last (Chair), *Organization*
F. M. Last (Vice Chair), *Organization*

F. M. Last, *Organization*
F. M. Last, *Organization*

The [Name of Consensus Committee] had the following membership at the time of its approval of this standard:

F. M. Last (Chair), *Organization*
F. M. Last (Vice Chair), *Organization*

F. M. Last, *Organization*
F. M. Last, *Organization*

5.2 Title

A standard's title should summarize the scope of the standard in as few words as possible. The title may consist of one, two, or three tiers:

- First tier: Names the general field of interest, which is usually the index listing in the most recent catalog of American National Standards. The first tier is always preceded by the word "for";
- Second tier: Gives the specific project or subject. The second tier defines a family of standards. Standards within a family are referred to as sister standards;
- Third tier: Defines the specific information covered and differentiates between sisters within a family.

5.3 Main text (body of standard – see pages 40 – 51 for examples)

For the purposes of this manual, the main text of a given standard shall be defined as all pages from the first page of text (page 1) to the end of the standard, including tables and figures. Appendices shall be treated separately. The main text of standards, exclusive of elements such as tables, figures, and footnotes, usually consists of several major sections each of which may be further divided into subsections as the text requires. Sections and subsections shall be numbered. It is particularly important that the wording preclude the possibility of more than one interpretation. Vague and indefinite terms should be avoided.

5.3.1 Organization and numbering system

5.3.1.1 Sections and subsections

The system for numbering sections of ANS standard is one that uses Arabic numerals in sequence. A subsection is designated by adding a period and sequential number to the section number (e.g., Sec. 5.1). This subsection, in turn, may be subdivided by a second period and a second sequential number (e.g., Sec. 5.1.1). There shall be no fewer than two subdivisions within a section or subsection and no more than six numbers set apart by periods (e.g., Sec. 5.1.1.1.1.1). This numbering system is not a decimal system; the period is used only to separate the numbers.

Cross-references are made by referring to Sec. 1, Sec. 2.2, Sec. 3.1.1.1, etc. The number and section headings may be used individually or together when referring to section headings; for example, “see Sec. 3,” and “see Sec. 5, General style.” The phrases “see above” and “see below” and other vague references to standards elements shall not be used.

Headings or section numbers alone (when no title is provide) shall be separated and placed above the first paragraph of the text of the section or subsection (see page 42 of the appendix for an example).

Only the first letter of the first word in a section or subsection title is capitalized. This is the same for sections and subsection heads in the table of contents.

While indentation is not generally used in the main text, it shall be used to highlight lists and notes within text and equations.

Italics may be used to emphasize an extremely important requirement or safeguard. However, this emphasis should be used sparingly. Boldface shall not be used for emphasis.

5.3.1.2 Introduction, scope, purpose, and application in Section 1 (see page 40 for examples)

An introduction may be used as an optional preliminary element, if necessary, to give specific information or commentary about the technical content of the standard, and about the reasons prompting its preparation. The standard shall include a statement of scope, to explain what is and, if necessary, what is not covered in the standard. The scope relates directly to the standard’s title and may be as short as one paragraph. A brief statement of the purpose of the standard and its intended applications may be provided. The introduction, scope, purpose, application, and any other introductory material shall not contain requirements.

The main heading of the section would be expanded as applicable with each subsection. Numbering and titles shall be organized as provided below:

1 Introduction, scope, purpose, application, [misc. other]

1.1 Introduction

1.2 Scope

1.3 Purpose

1.4 Application

5.3.1.3 Acronyms, initialisms, and definitions in Section 2 (see pages 40 – 41 for examples)

Acronyms and initialisms are used to define terms that are used more than once within the main text. The term is to be spelled out with the acronym or initialism in parenthesis in the first use followed by the use of the acronym alone in subsequent uses. A list of acronyms and initialisms shall be prepared if more than five acronyms are used.

The definition for “shall, should, and may” shall be included in all ANS standards and shall precede the list of technical terms. The following definitions shall be included:

> **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.

If the standard contains terms that have special technical meanings or are unique in the field, such terms should be defined in a definitions section. Definitions should be coordinated with other ANS standards and in particular with those in sister standards. The same term shall be used throughout each standard or series of standards to designate a given concept. The use of an alternative term (synonym) for a concept already defined shall be avoided. Definitions for terms used in ANS standards have been collected and are available in the ANS Glossary of Definitions available in the Toolkit for ANS Standards Development and Maintenance. Working group members shall refer to the ANS Glossary of Definitions to insure consistent use of terminology.

The main heading of the section would be expanded as applicable with each subsection. Numbering and titles shall be organized as provided below:

2 Acronyms and definitions

2.1 Acronyms

2.2 Shall, should, and may

2.3 Definitions

Unlike other section titles, the terms do not "float," but are run into the text of the definition and are separated from the text by a colon. Both the term and the colon shall be set in boldface. Terms shall be arranged in alphabetical order and shall not be capitalized unless, as in proper names, capitalization is mandatory. An example is provided below:

apportioning: The process of distributing population data from a dataset where data are aggregated in geographic units (e.g., census tracts or block groups) that do not match the polygon shape of the defined areas within the study area (e.g., sectors or uniform grid squares).

base year: The year from which the demographic data used in the analysis originated. Most typically it is the most recent census data.

Census Bureau geographic unit: The term means any of the following: block, block group, county, county equivalent, census county divisions, census tract, enumeration district, incorporated places (e.g., cities or villages), minor civil division (e.g., town or township), or state.

5.3.1.4 Figures and tables (see pages 46 – 50 for examples)

Figures and tables shall be numbered consecutively in the order of their reference in the text and in separate series; for example, Fig. 1, Fig. 2, Fig. 3, and Table 1, Table 2, Table 3. In the text, the term "figure" is abbreviated. Both Fig. and Table are in initial uppercase.

The following guidelines apply to figures:

- Figure titles shall be set in the form "Figure X – Figure title."
- Arabic numerals shall be used to number figures and they shall be numbered in the order in which they are first mentioned in the text.
- Figures shall be cited in the text in the form "Fig. X."
- Footnotes and/or notes may be used in figures to elaborate on or further clarify data or drawings that are part of a figure.

- Notes shall be either general in nature, applying to the entire figure, or specific in nature, applying to a specific part of the figure.
- Specific notes are cross-referenced in the figure; general notes are not.
- A single short note may be placed directly on the figure.

The following guidelines apply to tables:

- Table titles shall be set in the form "Table X – Table title" with table titles repeated on the second and subsequent pages in the form "Table X (Cont'd)"
- Arabic numerals shall be used to number tables and they shall be numbered in the order in which they are first mentioned in the text.
- Both notes and footnotes may be used to elaborate or further clarify data found in tables. Notes shall be used in tables to communicate information that applies to the entire table; they are general comments. Footnotes are used to clarify a specific piece of data within the table.
- Only the first letter of the first word in a heading, column heading, or column subheading shall be capitalized. In line headings and subheadings, only the first letter of the first word and proper nouns and adjectives shall be capitalized.
- Periods shall be omitted at the ends of lines.
- Column heads shall be repeated on each page of a continued table.
- The same units of measure shall be used through each column. Units with different orders of magnitude shall not be combined.
- Abbreviations and letter symbols shall be used in column and line headings and in the body of the table wherever possible.
- Notes and footnotes shall be presented at the end of the table, enclosed by an extension of the perimeter box. Notes shall be set before footnotes.

5.3.1.5 References, excerpts, and footnotes

Standards typically use references to substantiate or supplement its requirements. Referencing other American National Standards is usually done in the text of a standard, but referencing other types of documents, including regulations, other government documents, and draft documents, requires special instructions.

References to and quotes from regulations and American National Standards may be included in the text of a standard. When a reference to or a quote from a regulation is made a requirement, a "shall" statement shall be used. The verbs "should" and "may" shall not be used in referring to or quoting from a regulation.

When referencing or quoting from an American National Standard, the verb used (shall, should, or may) shall accurately reflect whether the document or its excerpt is being made a requirement, is being recommended for use, or is permitting its use.

If a regulation or American National Standard is used to justify a value used in the standard or to support a requirement in the standard, a footnote shall be used to cite the reference. An example of the use of a footnote follows.

> A similar requirement is set forth in a regulation.[1)]
>
> [1)] See 10CFR50.76(b).

Also, a footnote shall be used when the standard points out that a regulation or American National Standard addresses the same, similar, or alternative concept as that being discussed in the standard. Regardless of whether the footnote applies to the last word, or the whole sentence, the footnote is placed at the end of the sentence. The footnote (being a superscript) should appear following the period. Likewise, a footnote would follow a comma; however, a footnote would precede a colon or a semicolon. A footnote applying to a word in the middle of the sentence shall be placed after the word.

Any document cited in the main text (including regulations and other government documents) needs to be listed in the last section of the main text in a section titled "References." Bracketed Arabic numerals are placed in the main text after the citation of the reference in the order in which it appear (e.g., [5][6][7][8]) with a corresponding number in the References Section with the full citation. A reference number at the end of the sentence is placed before the punctuation. For the ease of the user, the citation of a referenced document in the text of a standard should be abbreviated [e.g., ANSI/ANS-19.6.1-2019 (R2024), EPRI NP-5223, Regulatory Guide 1.167]. Cited documents shall be obtainable by the user at a reasonable cost. Documents not cited that may be of benefit to users may be provided in a final appendix as a bibliography.

Excerpts from a government document may be used without quotation marks because they are not copyrighted. Excerpts from ANS standards, ANS publications (including ANS published technical papers) can be made without obtaining permission, unless protected by a third-party copyright. Excerpts from other sources (published books, journals, and non-ANS standards) are typically protected by copyright and require permission from the publisher and thus should be avoid. Should the use of copyright materials be deemed necessary, the working group chair shall contact the ANS standards staff to request copyright permission. In all cases, the source of the material excerpted shall be cited as a reference and acknowledged in a footnote.

When withdrawn standards are referenced, the standard's status as withdrawn shall be recognized with the word "(withdrawn)" following its designation. The most current version of a reference should be cited unless inappropriate. Future revisions shall not be referenced.

Cited references and excerpts shall comply with C3, Policy on Handling References and Excerpts in Standards in the Policy Manual for the ANS Standards Committee available in the Toolkit for ANS Standards Development and Maintenance.

The following statement shall be included at the beginning of the references section:

> The user is advised to review each of the following references to determine whether it, a more recent version, or a replacement document is the most pertinent for each application. When alternate documents are used, the user is advised to document this decision and its basis.

Examples of reference formats used in the References Section are provided below:

[1] NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition*, U.S. Nuclear Regulatory Commission.

[2] H. KOUTS, Letter to B. RUSCHE, U.S. Nuclear Regulatory Commission (Apr. 6, 1976).

[3] ANS-59.2-1985 (withdrawn), *Safety Criteria for HVAC Systems Located Outside Primary Containment,* American Nuclear Society.

[4] *Code of Federal Regulations*, Title 10, "Energy," Part 50, "Domestic Licensing of Production and Utilization Facilities," U.S. Nuclear Regulatory Commission (2017).

[5] "Principles and Recommendations for Population and Housing Consensus," Rev. 2, ST/ESA/STAT/SER.M/67/Rev.2, United Nations (2008). Available at https://unstats.un.org/unsd/demographic/sources/census/census3.htm (current as of June 11, 2018).

[6] Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations," U.S. Nuclear Regulatory Commission (2014).

[7] "Site Evaluation for Nuclear Installations: Safety Requirements, No. NS-R-3 (Rev 1)" IAEA Safety Standards Series No. NS-R-3, International Atomic Energy Agency, Vienna, Austria, 2016, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1709web-84170892.pdf.

[8] SAND93-0848, M. YOUNG, "Evaluation of Population Density and Distribution Criteria in Nuclear Power Plant Siting," Sandia National Laboratories (June 1994).

[9] ANSI/ANS-58.14-2011 (R2022), *Safety and Pressure Integrity Classification Criteria for Light Water Reactors*, American Nuclear Society.

[10] ACI 318-25, *Building Code Requirements for Structural Concrete*, American Concrete Institute.

[11] ANSI/ASCE/SEI 7-22, *Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers.

[12] ANSI/ASME NQA-1-2024, *Quality Assurance Requirements for Nuclear Facility Applications*, ASME International.

[13] ASTM D4430-00(2023), *Standard Practice for Determining the Operational Comparability of Meteorological Measurements*, ASTM International.

[14] DOE-STD-1189-2016, *Integration of Safety into the Design Process*, U.S. Department of Energy (2016).

[14] *ASME Boiler and Pressure Vessel Code*, American Society of Mechanical Engineers (2023).

[15] D. A. BROWN et al., "ENDF/B-VIII.0: The 8th Major Release of the Nuclear Reaction Data Library with CIELO-Project Cross Sections, New Standards and Thermal Scattering Data," *Nucl. Data Sheets*, 148, 1–142 (2018); https://doi.org/10.1016/j.nds.2018.02.001.

5.3.1.4 Appendices (see page 17 and 52 for examples)

Appendices in ANS standards shall be provided for informational purposes only for clarification, illustration, and general information in respect to the standard. They shall be within the scope of the project

under which the standard was developed and promulgated, and they shall not be inconsistent with the standard itself. They shall not contain requirements: mandatory (shall) requirements are rightfully a part of a standard and shall not be placed in an appendix.

All appendices shall have a title indicating the content of the appendix. Consecutive letters and a heading shall be used to identify each appendix; however, no letter is used in the heading if there is only one appendix. Appendices shall be called out in the main text and listed numerically in the order in which they are cited. If a Bibliography appendix needs to be created, it is the last appendix in the standard. Format examples are provided below:

When the standard has only one appendix:

Appendix

(This appendix does not contain any requirements of American National Standard ANSI/ANS-X.X-202x, [*Title*], but is included for informational purposes.)

Cleaning Procedure for New Cylinders

When the standard has more than one appendix:

Appendix A

(This appendix does not contain any requirements of American National Standard ANSI/ANS-X.X-202x, *[Title]*, but is included for informational purposes.)

Cleaning Procedure for New Cylinders

Appendix B

(This appendix does not contain any requirements of American National Standard ANSI/ANS-X.X-202x, [*Title]*, but is included for informational purposes.)

Method for Decontaminating Cylinders

The text of the appendix shall be organized and numbered as described in Sec. 5.3.1.1, but the section or subsection number shall be prefaced with the identifying letter of the appendix and a period. (Sec. 1 in Appendix A or a single appendix is numbered A.1; Subsection 1.1 in Appendix A is numbered A.1.1).

Figures and tables included in an appendix shall carry the identifying letter of the appendix in which they appear; the first figure in Appendix A shall be identified as Fig. A.1, the first figure in Appendix B shall be identified as Fig. B.1, etc. (See also Sec. 5.3.1.4.)

6 Special elements

6.1 Mathematical expressions (equations) (see page 51 for an example)

6.1.1 General

In preparing equations, where possible, use standard nomenclature appropriate to the field. Equation terms shall be defined immediately following each equation or in a separate table of symbols.

6.1.2 Type specifications and spacing

The text of an equation (Arabic numerals and English letters) shall be set in 11 point Times New Roman font. It is important that symbols used in the text are consistent with symbols used in equations. All variables shall be set in italic type.

The multiplication sign (×, Alt+0215) should be used for multiplication operations instead of the letter x or a point (•), and a minus sign (−, Alt+8722) should be used instead of hyphen (-) for subtraction signs. A single space should surround all operators. No space shall be placed between a number and the % sign.

There shall be one 11 point line space preceding and following a displayed equation. There shall also be one 11 point spacing between the end of the equation and the introductory term "where:", between "where:" and the first variable definition, and between all subsequent variable definitions. See Sec. 6.1.5 for equation numbering.

6.1.3 Indentation and division of equations

Displayed equations shall be centered. Equations that are longer than the width of the column shall be divided in accordance with the rules described in the *Chicago Manual of Style*, 17th Edition. When an equation is divided, the first line shall be indented 1 em and subsequent lines shall be indented 2 em for clarity.

6.1.4 Equations as parts of sentences

When an equation is part of a full sentence, the equation itself and the passage that follows it defining its terms shall be presented as the continuation of that full sentence. The equation shall be followed by a comma (centered vertically on the last line of the equation). The introductory term "where" shall be followed by a colon. Semi-colons shall follow each of the term definition lines except the last. The last term definition line ends with a period. The word "is" shall be used instead of an equals sign between the variable and its definition. When actual values are given for variables, an equals sign (=) shall be used instead of "is."

6.1.5 Numbering

If a standard contains several displayed equations, they should be numbered in sequence to facilitate reference preceded by the abbreviation "Eq." in parenthesis [e.g., (Eq. 1), (Eq. 2), (Eq. 3)]. Equation number in appendices shall include the appendix letter [e.g., (Eq. A.1), (Eq. A.2), (Eq. A.3)]. Equation numbers are set in 11 point Times New Roman font. Numbers are set right-aligned against the right margin and are centered vertically on the line following the equation.

6.1.6 Presentation of complex fractions

While fractions are normally presented in the form X/Y (see Sec. 7.4), the occurrence of complex fractions shall warrant the use of a horizontal divisor bar.

6.2 Lists (see page 43 - 45 for examples)

All elements of a list shall be set in 11 point Times New Roman font. Lists of a few words or less need no spacing between list items. A minimum of a 6-point line space should be used between lists of phrases and sentences.

6.2.1 Format of introduction to list

Lists may be introduced in one of two ways:

Formal introduction: The phrase just before the list that prepares the reader for the list that follows. It may include such words as “the following,” “as follows,” “for example,” “for instance,” etc. Formal introductions always end with a colon (:).

Introductory phrase: A sentence fragment that is completed by the text that makes up the list. Introductory phrases do not take any end punctuation.

6.2.2 Introducing a list member

6.2.2.1 Nonprocedural lists

Each member of a list that does not detail a procedure shall be introduced by a bullet (•). A hallow bullet (○) shall be used when a member of the list contains a short list of its own.

When a technical contact knows that there will be a cross-reference to a listing in a nonprocedural list, the bullets may be replaced by lowercase letters and Arabic numerals, as described in Sec. 6.2.2.2. (See also Sec. 6.2.4.)

6.2.2.2 Procedural lists

When the parts of the list detail an exact order of steps (i.e., steps to be followed in a test procedure), the first level of steps shall be introduced by lowercase letters and the second level by Arabic numerals. The first level shall be indented .25” and shall form a new left margin for the text (and any notes) that follow; the second level shall be indented another .25” and shall form a new left margin for the text (and any notes) that follow.

6.2.3 Capitalization and punctuation of lists

The commonly accepted rules of capitalization and punctuation shall apply to the text contained in lists in American National Standards. This means that proper names would retain their initial capital letter, and acronyms would be written in all capital letters, and both could still be considered in accordance with the requirements listed in Secs. 6.2.3.1 through 6.2.3.2.

The end punctuation of a complete sentence is usually a period. Some complete sentences in a list end in a semicolon only to show the continuation of the list. Each level of a 2-level list is treated independently with regard to capitalization and punctuation.

6.2.3.1 Lists following a formal introduction

6.2.3.1.1 Single words or phrases

When a list of words or phrases follows a formal introduction, the first letter of the word or the first letter of the first word of the phrase shall be lowercase, and all members of the list (except the final member) shall be punctuated with a semicolon. The final member of the list shall be punctuated with a period.

6.2.3.1.2 Single full sentences

When single full sentences follow a formal introduction (e.g., a test procedure), the first letter of the first word of each full sentence shall be capitalized. The punctuation shall be as described in Sec. 6.2.3.1.1.

6.2.3.1.3 More than one full sentence

When any or all members of a list are made up of two or more sentences, the first letter of the first word of each sentence shall be capitalized. The first and subsequent sentences shall be punctuated in accordance with the accepted rules for punctuation. The final sentence in a multi-sentence member of a list shall be punctuated in accordance with Sec. 6.2.3.1.1.

6.2.3.1.4 Phrases and full sentences

When a phrase in a list is followed by a full sentence, that part of the list shall follow the punctuation rules outlined in Sec. 6.2.3.1.3. All other parts of the list shall follow the punctuation and capitalization requirements described in Sec. 6.2.3.1.1. The first letter of the first word of a phrase shall not be capitalized (see Sec. 6.2.3.1.1).

The combination of phrases and full sentences in a list should be avoided, if possible.

6.2.3.1.5 Headings used in list members

Headings in lists may be used when the technical contact wants to summarize the sentences that follow the subtitle. Headings may be either words, phrases, or full sentences, but the format of the headings shall be consistent within the same list.

Headings shall be set in italic type and shall be punctuated with an italic colon. The first letter of the first word of each heading shall be capitalized.

If the paragraph that follows the heading is short (1-5 sentences), the end punctuation described in Sec. 6.2.3.1.1 shall be used for the final sentence. If the paragraph that follows has more than five sentences, regular end punctuation may be used for the final sentence, and the reader will rely on the usage of headings to determine the end of the list.

Headings shall only be used with formal introductions.

6.2.3.2 Lists following an introductory phrase

6.2.3.2.1 Single words or phrases

When a list of words or phrases follows an introductory phrase, the same requirements for capitalization and punctuation described in Sec. 6.2.3.1.1 shall apply.

6.2.3.2.2 Single full sentences

When single full sentences follow an introductory phrase, the first letter of the first word should be lowercase, since each sentence in the list is actually the second half of a compound sentence. The punctuation shall be as shown in Sec. 6.2.3.1.1.

6.2.3.2.3 More than one full sentence

When any or all members of a list are made up of two or more sentences, the first letter of the first word of the first sentence shall not be capitalized. In subsequent sentences, the first letter of the first word is capitalized.

The punctuation of the first and subsequent sentences shall be in accordance with the accepted rules for punctuation. The final sentence in a multi-sentence member of a list shall be punctuated in accordance with Sec. 6.2.3.1.1.

6.2.3.2.4 Phrases and full sentences

When a phrase in a list is followed by a full sentence, that part of the list shall follow the punctuation rules outlined in Sec. 6.2.3.2.3. All other parts of the list shall follow the punctuation and capitalization requirements described in Sec. 6.2.3.1.1.

As mentioned in Sec. 6.2.3.1.4, the combination of phrases and full sentences in a list should be avoided, if possible.

6.2.4 References to lists

When a reference is made to a single listing in a list that does not detail a procedure (see Sec. 6.2.2.1), the reference shall be made to the section or subsection containing the list.

If a reference to just a section or subsection would be too confusing to reader and the technical contact wishes to make a reference to a particular listing in a list that does not detail a procedure, lowercase letters and Arabic numerals may be used to delineate listings in that list as described in Sec. 6.2.2.2. When a reference is made to a single listing in a list that details a procedure (see Sec. 6.2.2.2), the reference shall be made to both the section or subsection containing the list and the letter or Arabic numeral delineating the referenced listing (e.g., “see Sec. 4.2 .4.5(b)”).

6.3 Notes

See page 46 of the appendix for a sample of a note and below in Sec. 6.3.2)

6.3.1 General

Explanatory statements may be used in the text for emphasis or for offering informative suggestions. Such statements shall be set apart from the text and shall be designated as notes.

Notes in the text or following a table or figure are an official part of the approved standard but shall not contain requirements. Notes should follow the section, subsection, paragraph, table, or figure to which it belongs.

6.3.2 References to notes

References to notes within the main text may be presented in two possible formats:

> Format 1, added to end of sentence: When the reference to a note is added at the end of the sentence, it shall have the format "…(see Note 1).";
>
> Format 2, as a separate sentence: When the reference is presented as a separate sentence, it shall have the format "end of sentence. (See Note 1.)."

Format 1 shall be used when the note refers to a concept presented within the preceding sentence. Format 2 shall be used when the reference is more general, applying to the entire paragraph, for example.

6.4 Footnotes

See page 40 and 53 of the appendix for footnote examples.

6.4.1 Usage

Footnotes may be used in a standard only for purposes of clarification, illustration, and general information in respect to the standard. Mandatory (shall) requirements are rightfully a part of a standard and shall not be placed in a footnote (see Sec. 7.8.1).

6.4.2 Numbering

Footnotes to the text shall be numbered consecutively beginning with [1)] in each section—the foreword, main text, and each appendix. Footnotes used in tables shall be numbered consecutively within the table.

6.5 Subscripts and superscripts

The legibility of superscripts and subscripts shall be maintained at all times. Symbols or letters having subscripts which themselves bear subscripts shall be avoided, if at all possible. For information on use of subscripts with abbreviations see Sec. 7.5.

7 General content and style

7.1 Spelling

The technical contact should use *Merriam-Webster's Collegiate Dictionary*, 11th Edition, as the guide to correct spelling. The form listed first shall be the preferred one in most cases. If an American National

Standard exists on the subject, however, the spelling presented in the standard takes precedence over *Merriam-Webster's*.

American spelling shall generally be preferred over European spelling. However, if an American National Standard is based on an existing International Standard or is designed to be consistent with such a document, European spelling may be accepted. The need for this specialized spelling shall be evaluated by both ANS's editor and the technical contact.

7.2 Hyphenation

7.2.1 Usage

The technical contact should consult *Merriam-Webster's Collegiate Dictionary*, 11th Edition, on the question of whether a compound should be hyphenated or presented as one or two words. Permanent compounds, those that have been accepted into the general vocabulary, can usually be found in the dictionary. For temporary compounds (the joining of words for a specific context) ANS's editor or the technical contact must make the determination. Multiple words joined by hyphens may be used as an adjective to define a noun, if necessary, but no more than three words shall be joined.

7.2.2 General hyphen and dash usage

Three types of hyphens and dashes are used in American National Standards: a regular hyphen (-), an en-dash (–), and an em-dash (—). The proper usage of these three elements shall be as follows:

A regular hyphen: A regular hyphen shall be used to hyphenate words and to join nouns to create an adjective (e.g., metal- bending device, as opposed to metal bending device);

- An en-dash: An en-dash shall be used to
  - distinguish listings within a list (see Sec. 6.2);
  - signify a range (i.e., the range is 1-3 inches);
  - separate an introductory warning term from the warning;
  - separate the number and caption in a table title or a figure title;
  - denote a relationship between two words (e.g., user-network interface).
- An em-dash: An em-dash shall be used to
  - separate tiers in the standard title, as set on the cover (see Sec. 5.2);
  - signify missing data in a table.

An em-dash may also be used to replace a comma in a sentence.

7.3 Capitalization

7.3.1 General

The *Chicago Manual of Style*, used by ANS's Publications Department as a guide to capitalization, points out that the current trend is toward more conservative use of capitals. Certainly, overuse and departure from conventional rules can reduce readability and may obscure meaning.

A technical contact may wish to capitalize a term or terms that are normally lowercased for a number of reasons, to highlight the technical usage of common terms, for example. Such cases should be evaluated individually by both the technical contact and ANS's editor. Trademarks, personal nouns, and abbreviations or acronyms that are normally capitalized shall not be reduced to lowercase.

The technical contact should follow the style described in Secs. 7.3.2 through 7.3.3 for capitalization of standards elements. The treatment of these elements is also covered in individual style subsections.

7.3.2 Heads, table titles, table elements, figure titles, and figure callouts

Only the first letter of the first word of these elements shall be capitalized. If subtitles are included (separated by an em-dash, see Sec. 7.2.2), the first word of each subtitle is capitalized.

7.3.3 Cross-references

The terms section, appendix, and figure shall be capitalized in cross-references.

7.4 Numbers

7.4.1 General usage

Arabic numerals shall be used for all units of measure, time, and physical quantity. Within general text, isolated numbers of less than ten shall be written out. Numbers applicable to the same category should be treated alike throughout a paragraph; do not use figures for some and spell out others. If the largest number in a paragraph contains three or more digits, figures shall be used for all.

No sentence shall begin with an Arabic numeral.

Equivalent values in different units shall be set in parentheses alongside primary unit data.

Fractions shall be set in the format "numerator/ denominator" (e.g., 3/4) and mixed fractions shall be set in the format "whole number-numerator/denominator" (e.g., 3-3/4).

7.4.2 Use of a decimal point

In a mixed decimal number, a decimal point shall be used to separate the whole number portion from the decimal portion.

7.4.3 Separation of numbers

To facilitate the reading of numbers, and when counting from the decimal point toward the left, digits shall be separated into groups of three. The groups should be separated by a space, not by a comma, a point, or any other means. It is not necessary to add a space to numbers containing only four digits.

If the magnitude of the number is less than unity, the decimal sign should be preceded by a zero (e.g., 0.15, not .15). No space should separate digits placed to the right of the decimal sign.

Examples: 73 722 123 372 4756 0.1334

7.4.4 Tolerances

If tolerances are provided, the technical contact shall give the unit with both the basic value and the tolerance (for example, 10 inches ± 1 inch, not 10 ± 1 inch.) There should be a space on both sides of the plus/minus (±) symbol.

There shall be no space between the operator and the tolerance when the primary dimension is not used (e.g., "There shall be a space of ±3 inches between the electrodes."). If the plus and minus tolerances are not the same, the tolerance shall be set as follows:

10 inches + 3 inches, -1 inch

when used in text (see Note 1), or

10 in +3 n
-1 in

when used in figures (see Note 2)

Notes:

1 In text, letter symbols for physical quantities may be used by the technical contact, but shall be used consistently.

2 In figures, dimensions and tolerances may also be written on one line, if space allows.

7.5 Abbreviations

7.5.1 Usage

Technical abbreviations shall only be used where necessary to save time and space and only where their meaning is unquestionably clear to the intended reader. Abbreviations and their corresponding full terms or words should be defined in the acronyms and definitions section.

Subscripts should not be used either in or with abbreviations. Variables, however, may be differentiated by subscripts. (See Sec. 6.5.) Variables shall be set in italic type to distinguish them from abbreviations.

7.5.2 Presentation

Periods shall be placed after all abbreviations in common usage (i.e., Mr., Jr., etc., Inc., Alt.). Accepted usage in the field shall determine whether uppercase or lowercase letters are used for abbreviations in text and titles.

7.6 Letter symbols for units

7.6.1 Usage

Letter symbols shall be preferred to abbreviations for expressing the units in which quantities are measured. The reason for this is that a letter symbol represents a quantity or unit (not its name) and is, therefore, universal and independent of language. Abbreviations, on the other hand, are conventional representations of words or names in a particular language and may be different in different languages.

7.6.2 Form

Unit symbols shall be written in lowercase letters, except for those derived from a proper name and a few that are not formed from letters. The distinction between uppercase and lowercase letters should be adhered to. Unit symbols shall be set in non-italic type. Their form shall be the same for both singular and plural, and they shall not be followed by a period. Both single and multiple letter symbols may be referenced in text.

7.7 Letter symbols for physical quantities

The same letter symbol should be used throughout a standard to indicate the same physical quantity, regardless of the units employed or of the special values assigned. American National Standards for letter symbols in particular fields should be used, if they have been established.

7.8 Special word usage

7.8.1 “Shall” and “should”

The word “shall” shall be understood as denoting a mandatory requirement. “Shall” shall be used wherever the criterion for conformance with the specific recommendation requires that there be no deviation. Its use shall not be avoided on the grounds that compliance with the standard is considered voluntary. “Shall” shall not be used in any foreword, introduction, purpose, application, scope, definition, appendix, note, or footnote.

The word “should” shall denote a recommendation. “Should” shall to be used wherever noncompliance with the specific recommendation is permissible. “Should” shall not be substituted for “shall” on the grounds that compliance with the standard is considered voluntary.

The use of “should” or “shall” shall have no bearing on the voluntary nature of American National standards. Inclusion of or reference to an American National Standard in a document, standard, or contract by a company, agency, or regulatory body is a voluntary act. When a standard is so cited, the standard shall become a requirement within the limitations set forth by the document, standard, or contract.

Table 1 (below) provides guidance on expressing requirements, recommendations, and permissions.

Table 1 – Acceptable and unacceptable wording of requirements, recommendations, and permissions in ANS standards

Expressing requirements	
Correct form	**Do not use other wording to express requirements (Note 1) such as:**
shall	• is to • is required to • it is required that • has to • Only … is permitted • it is necessary • must • will • is acceptable • shall consider
shall not	• is not allowed • is not permitted • is not acceptable • is required to be not • must not • will not
Expressing recommendations	
Correct form	**Do not use other wording to express recommendations such as:**
Should	• it is recommended that • ought to • shall consider
should not	• it is not recommended that • ought not to be
Expressing permissions	
Correct form	**Do not use other wording to express recommendations such as:**
May	• is permitted • is allowed • is permissible • is acceptable
Note: It may be acceptable to use some of these words to express statements of fact.	

7.8.2 "And/or"

The term "and/or" shall be avoided and, wherever possible, the statement shall be rewritten to clarify the meaning. For example:

Heel pads or sock linings, or both; not, heel pads and/or sock linings

Nuts, or screws, or bolts, or a combination thereof; not, nuts, screws, and/or bolts

7.8.3 "That" and "which"

"That" is a defining, or restrictive pronoun. "Which" is a nondefining, or nonrestrictive pronoun. For example: "The lawn mower that is in the garage is broken." (Tells which one.) "The lawn mower, which is broken, is in the garage." (Adds a fact about the only mower in question.)

7.8.4 Nouns and adjectives

Nouns may be used as adjectives, provided these adjectives are no longer than three words (see Sec. 7.2.1).

7.8.5 Nontechnical expressions

Nontechnical expressions should be used wherever possible. If unusual terms are used, they should be defined.

7.9 Metric and customary units

As specified in Annex D of the Standards Committee Rules and Procedures, the ANS Standards Committee actively encourages the use of the International System of Units (SI) in the writing of standards, and specifically that SI units should either be provided parenthetically alongside English units or SI units alone should be used, unless to do so would significantly impede the progress of the standards.

8 Clarity of requirements and recommendations

Requirements and recommendations specified within ANS standards documents shall be presented in an unambiguously clear and explicit manner. There are multiple ways of doing this. The standard document's responsible working group and consensus committee shall determine the most appropriate approach for clearly presenting requirements and recommendations.

Three examples of acceptable presentation approaches are shown below:

(1) Visibly **bolding** requirements and/or recommendations that are embedded within the document's text as shown below:

> ***1.1.1.1 Review of the PRA for deterministic insights***
>
> *A review of the accident sequences of the PRA adjusted in accordance with Sec. 5.2.1.1* ***shall*** *be performed to identify any safety-significant mitigating system equipment malfunctions that* ***should*** *be included in the design-basis analysis. Potential equipment malfunctions* ***shall*** *include those single failures and coincident occurrences that, when combined with a given initiating event, can challenge fuel design limits, the integrity of the primary coolant system in accordance with the ASME Boiler and Pressure Vessel Code [15], or release magnitudes on the order of 10 CFR Part 100 limits [4].*

A tabular listing of requirements and/or recommendations at appropriate locations throughout the specific standard's document such as at the end of a section of the text as shown below from ANS-53.1-2011 (R2021), *Nuclear Safety Design Process for Modular Helium-Cooled Reactor Plants:*

3.3.2.2 Remove core heat

The plant is designed to ensure reactor decay heat removal during AOOs relying primarily on active standby core cooling systems. During DBEs and BDBEs, the plant may rely solely on passive core cooling systems. The principal safety requirement is to ensure reliable decay heat removal.

The plant decay heat removal systems shall be designed for performance and reliability during normal and AOO conditions using active standby core cooling systems. The plant shall have the capability to remove reactor decay heat during AOOs relying primarily on active standby core cooling systems without exceeding the TLSC for AOOs.

During DBEs and BDBEs, the core heat function (core heat removal) shall be capable of being performed solely by passive means using conduction, convection, and radiation characteristics of the core components in conjunction with a passive RCCS to discharge core decay and residual heat to the ultimate heat sink. The plant shall have the capability to remove reactor decay heat during DBEs and BDBEs without exceeding the respective TLSC for DBEs or BDBEs relying solely on passive core cooling systems. The plant shall have the capability to remove reactor decay heat during the deterministically selected DBAs solely with safety functions performed by the required safety-related SSCs without exceeding the TLRC for DBAs.

During active and/or passive core heat removal, the fuel temperature shall not exceed the fuel temperature design limits where excessive fuel failure could occur over a large portion of the core. A limited amount of TRISO fuel failure is acceptable; however, site boundary dose limits ultimately determine the amount of fuel failure allowed.

Table 11 – Summary of requirements for removal of core heat

Designator	Requirement
3-RCH-1	*The plant decay heat removal systems shall be designed for performance and reliability during normal and AOO conditions using active standby core cooling systems.*
3-RCH-2	*The plant shall have the capability to remove reactor decay heat during AOOs relying primarily on active standby core cooling systems without exceeding the TLSC for AOOs.*
3-RCH-3	*During DBEs and BDBEs, the core heat function (core heat removal) shall be capable of being performed solely by passive means using conduction, convection, and radiation characteristics of the core components in conjunction with a passive RCCS to discharge core decay and residual heat to the ultimate heat sink.*
3-RCH-4	*The plant shall have the capability to remove reactor decay heat during DBEs without exceeding the TLSC for DBEs relying solely on passive core cooling systems.*
3-RCH-5	*The plant shall have the capability to remove reactor decay heat during BDBEs without exceeding the TLSC for BDBEs relying solely on passive core cooling systems.*
3-RCH-6	*The plant shall have the capability to remove reactor decay heat during the deterministically selected DBAs solely with safety*

Designator	Requirement
	functions performed by the required safety-related SSCs without exceeding the TLRC for DBAs.
3-RCH-7	*During active and/or passive core heat removal, the fuel temperature shall not exceed the fuel temperature limits where excessive fuel failure could occur over a large portion of the core.*

(2) Structuring the standard's document around the specification of requirements and/or recommendation from another source such as the General Design Criteria, etc., as shown below from Sec. 3.3.1 in ANS-20.2-2023, *Nuclear Safety Design Criteria and Functional Performance Requirements for Liquid-Fuel Molten Salt Reactor Nuclear Power Plants:*

3.3.1 Criterion 20: protection system functions

The protection system shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable radionuclide release design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety.

Rationale for Adaption to GDC: Derived from MHTGR-DC – grammar correction. Reason for change from GDC - Liquid fuel cannot be readily damaged. A conservative safety concept that preserves the safety intent of the GDC is retention of radionuclides.

9 Values cited

The validity of numerical criteria (including equations, formulas, or methods used to obtain such values) shall be substantiated and documented by the responsible working group. Values that are made a part of the requirements of a standard shall have a sound technical basis. Working group chairs shall ensure that a documentation file is created and submitted to ANS staff prior to publication of the standard. Acceptable methods and cautions in substantiating a value can be found in the ANS Standards Committee Policy Manual in C2, Policy on the Substantiation of Values Cited in ANS Standards.

10 Special ANSI policies

10.1 Patented items

Although there is no objection in principle to developing an American National Standard that calls for the use of a patented item, this practice should be avoided if practicable. Where it is considered necessary for technical reasons to include a patented item, the technical contact should follow the current ANSI Patent Policy. The present version is the 2025 ANSI Essential Requirements: Due process requirements for American National Standards).

10.2 Commercial equipment

References to commercial equipment in a standard shall be generic and shall not include trademarks or other proprietary designations. Where a sole source exists for essential equipment or materials, it is permissible to supply the name and address of the source in a footnote, so long as the words "or the equivalent" are added to the reference.

10.3 Effective dates

American National Standards are promulgated through ANSI for voluntary use. However, users, distributors, regulatory bodies, certification agencies, manufacturers, and others concerned may apply American National Standards as mandatory requirements in commerce and industry. Such applications may require the establishment of effective dates for the provisions of the standard.

Effective dates shall not be part of the standard approved by ANSI. Such dates may be included in published American National Standards only when authorized by the technical contact and only if it is clearly shown that they are not part of the standard. Effective dates may appear on the cover of the publication, in the foreword, as footnotes, or in parentheses following a provision to which such a date applies.

When an effective date appears in any portion of a published American National Standard (or in a proposed American National Standard), the following statement or its equivalent shall be included:

> The effective date is established by the standards development organization and not by the American National Standards Institute.

10.4 Placement of tables and figures relative to text

Before final formatting can be completed on the main text, a decision must be made regarding the positioning of tables and figures (if any) relative to the text. There are two options:

- to intersperse these elements where referenced;
- to place them following main text (preceding any appendix).

It is preferable to incorporate tables and figures within the main text where referenced; however, a series of numerous or complex tables may follow the main text.

Tables and figures do not have to be treated the same with regard to placement; figures can be placed after the main text and tables can be interspersed, or vice-versa. However, all figures shall be treated the same with regard to placement and all tables shall be treated the same with regard to placement.

Tables and figures may be positioned portrait or landscape depending on size.

10.4.1 Interspersing

10.4.1.1 General

If many tables or figures are referenced in one portion of the text or if the table or figure will fill an entire page (before or after a reduction), these figures and tables may appear on the pages that follow their reference. Any figure or table appearing alone on a page shall be centered both vertically and horizontally on the page.

10.4.1.2 Adjustment of columns

The length of the columns of text appearing above or below referenced figures and tables depends on the length and width of the figure or table. The length of the columns shall be adjusted to accommodate the length of the figure or table.

10.4.1.3 Spacing

The baseline of the main text preceding or following an interspersed table or figure shall be spaced 20 point from the closest element of the figure or table (the first or last line of a table or the top or bottom of a figure).

10.4.1.4 Figure reductions

Oversized figures shall be reduced to fit within a maximum width of 6.5" and a maximum length of 9". The clarity of the figure shall not be lost in the reduction.

10.4.2 Following main text

If there are more than 10 tables or figures and placing them within the text would cause the text to be interrupted too frequently, they may all be placed as a group following the main text and before any appendices. If both tables and figures are placed after the main text, tables shall precede figures.

Any figure or table appearing alone on a page shall be centered both vertically and horizontally on the page.

10.4.3 Table of contents (see page 39 for an example)

The table of contents shall be added using Microsoft Word Table of Content function once the draft has been completed. The following order shall be used:

- main text sections and subsections
- appendices
- tables
- figures

Appendix

(This appendix is provided for illustrative purposes.)

Sample Standards Elements

This appendix contains sample standards elements taken from published ANS standards. It was created for the purpose of illustrating the written specifications and policies in Secs. 1 through 10 of the ANS Standards Style Manual. Examples start on the next page. No example of a cover is provided since the ANS staff will insert the cover as part of the final proof before publication.

A.1 Title Page

NOTE: This is the only page that should NOT have the header.

Text should have 1" border throughout the standard except headers/footers.

Headers/footers should be 1/2" from top/bottom of sheet.

NO page numbers on the first few pages. Page numbers start on the foreword in lowercase Roman numerals.

ANSI/ANS-1.23-2025

Arial 12 pt.

American National Standard
The Title of the Standard to be Entered Here

Arial 15 pt.

Times New Roman in 12pt. font for text in circle.

Secretariat
American Nuclear Society

Prepared by the
American Nuclear Society
Standards Committee
Working Group ANS-1.23

Published by the
American Nuclear Society

Approved Month X, 202X
by the
American National Standards Institute, Inc.

A.2 Copyright page

This header must appear on every page except the "Title Page" which is the first page.
Font for the header is 9 pt Times New Roman.

American National Standard

14 pt Arial Bold

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.

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.

10.5 pt Times New Roman (All)

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. Inquiries about requirements, recommendations, and/or permissive statements (i.e., "shall," "should," and "may," respectively) should be sent to the Society headquarters, ATTN: Standards or to standards@ans.org. Action will be taken to provide an appropriate response in accordance with established procedures that ensure consensus.

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

Published by

American Nuclear Society
1111 Pasquinelli Drive
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11 pt Times New Roman (All)

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A.3 Inquiry page

Inquiry Requests

The American Nuclear Society (ANS) Standards Committee will provide responses to inquiries about requirements, recommendations, and/or permissive statements (i.e., "shall," "should," and "may," respectively) in American National Standards that are developed and approved by ANS. Responses to inquiries will be provided according to the Policy Manual for the ANS Standards Committee. Nonrelevant inquiries or those concerning unrelated subjects will be returned with appropriate explanation. ANS does not develop case interpretations of requirements in a standard that are applicable to a specific design, operation, facility, or other unique situation only and therefore is not intended for generic application.

Responses to inquiries on standards are published in ANS's magazine, *Nuclear News*, and are available publicly at www.ans.org or by contacting standards@ans.org.

14 pt. Arial Bold

10.5 pt Times New Roman (All)

Inquiry Format

Inquiry requests shall be submitted on the Standards Inquiry Submittal Form available at https://ans.org/standards/docs/inquiry-submittal-form.pdf. Requests shall include the following:

(1) the name, company name if applicable, mailing address, and telephone number of the inquirer;

(2) reference to the applicable standard edition, section, paragraph, figure, and/or table;

(3) the purpose(s) of the inquiry;

(4) the inquiry stated in a clear, concise manner;

(5) a proposed reply, if the inquirer is in a position to offer one.

Inquiries should be addressed to

American Nuclear Society
ATTN: Standards
1111 Pasquinelli Drive
Suite 350
Westmont, IL 60559 USA

or standards@ans.org

Foreword

(This foreword does not contain any requirements of American National Standard ANSI/ANS-1.23-2025, *Insert the Title of the Standard Here*, but is included for informational purposes.)

This standard presents the training outline, procedures, and responsibilities for providing appropriate training for personnel who work in nuclear facilities The standard calls for designating personnel requiring training and establishing learning objectives. It provides a framework of training elements and criteria for program documentation and evaluation.

The ANS-1.23 standard was first developed in response to a need identified in the 1980s by the training work group of the Standards Safety Project. The first American National Standards Institute approval as ANS-1.23-2000.

This revision, ANSI/ANS-1.23-2025, is the first since that original offering issued in 2000 prepared by the ANS-1.23 Working Group of the Nuclear Facilities Subcommittee of the Standards Committee of the American Nuclear Society. The members of the working group represent perspectives from multiple segments of the community.

The working group has determined that this standard does not benefit from inclusion of risk-informed and/or performance-based requirements.

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 was prepared by the ANS-1.23 Working Group of the American Nuclear Society. The following members contributed to this standard:

D. A. Jones (Chair), *Jones International, Inc.*
T. A. Little (Vice Chair), *Individual*

L. M. Adson, *Appleton National Laboratory*
W. M. Bari, *Individual*
B. A. Curdick, *Individual*
T. Darnell, *Oak Ridge Technology, Inc.*
B. Farris, *NNP Solutions*
B. J. George, *George & Sons, LLC*
P. A. Kenney, *LLNL Operations, Inc.*
W. R. Schnieder, Nuclear *Solutions, Inc.*
C. P. Tatinger, *Atwater Nuclear Training*
T. T. Waters, *University of Peoria*

The Nuclear Facilities Subcommittee had the following membership at the time of its approval of this standard:

K. E. Boregard (Chair), *Sarasota Nuclear Company*
F. M. Michaels (Vice Chair), *Harrington Nuclear Security, LLC*

A. S. Barker, *High Priorities Tech, Inc.*

P. J. Cummings, *A-Z Nuclear Security*
E. F. Ellington, *Individual*
J. F. Growner, *Combined Services*
P. T. Libby, *Individual*
B. T. Patricia, *Amana Services, Inc.*
R. T. Thompson, *Thompson Nuclear Consulting*
A. M. Whittington, *Power Unlimited*

The Nuclear Plants and Facilities Consensus Committee had the following membership at the time of its approval of this standard:

T. T. Warren (Chair), *Bakers and Associates*
A. R. Schweitz (Vice Chair), *A.R. Engineering, Inc.*

D. Benzy, *Individual.*
G. J. Burg, *Government Services*
K. E. Boregard, *Sarasota Nuclear Company*
H. Duffy, *Frenrich, Inc.*
M. R. Earnest, *Times Technologies, Inc.*
N. M. Harnet, *Individual*
K. A. Houpert, *Individual*
R. D. Kennedy, *Institute of Nuclear Plants and Facilities*
S. T. Murphy, *Radiation Society of America*
U. E. Wagner, *Individual*

A.5 Table of contents

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Contents

14 pt Times New Roman Bold

Section **Page**

10.5 pt. Times New Roman

14 pt Times New Roman Bold

A.6 Main text

This page starts the formal/ requirements portion of the standard. Page numbering starts at 1.

Environmental Monitoring at Nuclear Facilities

Title of the standard in 28 pt Times New Roman

-20 pt space before Level 1 headings

-14 pt Times New Roman for Level 1 title
-Only first word capitalized.

1 Introduction and scope

1.1 Introduction

Meteorological data collected, processed, stored, and disseminated through implementation of this standard are utilized to support the full life cycle (i.e., siting, design, construction, operation, and decommissioning) of nuclear facilities. The meteorological data are employed in a large number of applications associated with determining environmental impacts, enabling consequence assessments in routine release and design-basis accident evaluations, supporting emergency preparedness and response programs, and other important applications, such as evaluating the impacts of beyond-design-basis events.

11 pt Times New Roman for body of standard.

Level 2 or greater headings also in 11 pt Times New Roman but in bold.

1.2 Scope

Footnote added for first time use of "This standard."

This standard[1)] provides criteria for gathering, assembling, processing, storing, and disseminating meteorological information at commercial nuclear electric generating stations, U.S. Department of Energy/National Nuclear Security Administration nuclear facilities, and other national or international nuclear facilities. While well-established monitoring and analysis methods are adequately addressed, this revision provides information on newer *in situ* and *ex situ* monitoring systems, both hardware and software, and more modern data management methods to keep pace with the state of the science.

Space = 20 pt

2 Acronyms and definitions

14 pt bold in Times New Roman for Level 1 heading

2.1 Acronyms

NOTE: An acronym list is included if there are 5 or more acronyms used in the standard.

ABL	atmospheric boundary layer
DQO	data quality objective
FAA	Federal Aviation Administration
HVAC	heating, ventilating, and air-conditioning
lidar	light detection and ranging
NEXRAD	next-generation weather radar
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
QA	quality assurance
radar	radio detection and ranging
RASS	radio acoustic sounding system

NOTE: Only proper nouns capitalized

Acronyms may be single spaced. Depends on pagination

11 pt Times New Roman font. Heading in bold.

[1)] The current standard, ANSI/ANS-3.11-2024, is hereinafter referred to as "this standard."

9 pt Times New Roman for footnotes

Page #s start at 1

sodar	sound detection and ranging
SRDT	solar radiation/delta temperature
TIBL	thermal internal boundary layer

2.2 Shall, should, and may

The definition for "shall, should, and may" is required to be added in all ANS standards.

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.

2.3 Definitions

air temperature: The temperature indicated by a thermometer exposed to the air in a place sheltered from direct solar radiation [1].[2)]

Footnote added to explain reference numbers the first time used. See below.

calm: Any wind speed below the starting threshold of the wind speed or direction sensor, or any wind speed below that which is appropriate for input into plume models, whichever is greater. In the United States, calm is typically defined as any speed less than 1 mph (0.4 ms^{-1}).

Terms are in bold followed by a colon.

Terms are in lower case unless they are a proper noun.

damped natural wavelength: A characteristic of a wind vane empirically related to the delay distance and the damping ratio [2].

delay distance: The distance that air flowing past a wind vane moves while the vane is responding to 50%

flat terrain: A region where wind flow is relatively uniform with no significant terrain effects that may alter the uniform airflow in the vicinity.

gust: According to U.S. weather observing practice, gusts are reported when the peak wind speed reaches at least 16 knots (i.e., ~8 m/s) and the variation in wind speed between the peaks and lulls is at least 9 knots (i.e., ~ 5 ms^{-1}). The duration of a gust is usually less than 20 seconds [1].

longwave radiation: A term used loosely to distinguish radiation at wavelengths longer than approximately 4 μm, usually of terrestrial origin, from those at shorter wavelengths (shortwave radiation), usually of solar origin [1].

mesoscale: The scale of atmospheric phenomena having overall horizontal dimensions from a few kilometers to several hundred kilometers with time scales from approximately 1 hour to 12 hours and vertical extents from tens of meters to the depth of the troposphere [3].

software quality assurance: All the planned and systematic activities implemented within a quality system that can be demonstrated to provide confidence that a software product or service will fulfill requirements for quality.

true north: The direction from any point on the earth’s surface toward the geographic North Pole [1].

wet-bulb temperature: The temperature an air parcel would have if cooled adiabatically to saturation at constant pressure by evaporation of water into it, with all latent heat being supplied by the parcel [1].

[2)] Numbers in brackets refer to corresponding numbers in Sec. 9, “References.”

9 pt Times New Roman

3 Meteorological monitoring system

Deployed meteorological monitoring systems shall meet site-specific and facility-specific requirements, while adhering to standard measurement heights, if possible. A basic meteorological monitoring program shall consist of measurements of horizontal wind speed, horizontal wind direction, air temperature, the difference between air temperatures at two vertical levels on a tower, liquid precipitation with a rain gauge, and any combination of additional measurements necessary to determine atmospheric stability class (see Sec. 3.2). Supplemental meteorological measurements, involving more sophisticated monitoring approaches or monitoring at more than one location, shall be deployed where appropriate, to adequately meet site and facility data requirements. Meteorological measurements shall meet the criteria for accuracy and resolution defined in Table 1. Table 1 provides values for a monitoring system using typical tower-mounted sensors and digital data processing systems.

3.1 Basic meteorological measurements

3.1.1

Subsection numbering stand alone when there is no subheading.

Horizontal wind speed shall be measured with a sensor suitable for continuous, accurate operation. Horizontal wind speed sensors shall have a starting threshold of no higher than 0.5 ms^{-1} (1.1 mph). The sensor shall operate over a range of horizontal wind speeds up to at least 22 ms^{-1} (50 mph) unless expected local conditions require a higher range. The survival speed should be at least approximately twice the normal operating range.

The standard vertical elevation or height for horizontal wind speed measurements shall be 10 m (33 ft.) above ground level. Additional measurements should be made at the level representative of the most probable atmospheric release height applicable to activities involving radioactive and toxic chemical substances, considering the input data requirements of atmospheric dispersion models used by facility analysts and emergency planners and responders. In some cases, horizontal wind speed measurements may be taken at other tower levels to meet specific requirements of the meteorological monitoring program. Additional information on horizontal wind speed measurements can be found in [6][7][8][9][10][11].

3.1.2

Example of format for multiple references.

Horizontal wind direction shall be measured with a sensor suitable for continuous, accurate operation. Horizontal wind vane sensors used for sigma theta (σ_θ) or sigma phi (σ_ϕ) applications shall have a damping ratio between 0.4 and 0.7 inclusive, at a 10–degree azimuth offset, and the damped natural wavelength shall be <10 m (<33 ft.). Horizontal wind direction sensors shall have a starting threshold speed of no higher than 0.5 ms^{-1} (1.1 mph) and shall operate over the expected range of horizontal wind speed conditions, or at least 22 ms^{-1} (50 mph). The survival speed should be at least approximately twice the normal operating range.

The criteria for determining the appropriate monitoring heights for horizontal wind direction are the same as those used for horizontal wind speed (see Sec. 3.1.1). The standard vertical height for horizontal wind direction measurements shall be 10 m (33 ft.) above ground level. Horizontal wind direction sensors shall be aligned such that the data collected will be referenced to true north. Additional information on horizontal wind direction measurements can be found in [10][12][13][14].

A.7 Lists

The following are examples of numbered lists.

3 Criteria

Font is Times New Roman.

L1 headings are in 14 pt bold.

Balance of text is 11 pt.

It is the purpose of this standard to provide criteria for the following:

(1) determination of the energy allocation among the principal particles and photons produced in fission, both prompt and delayed;

(2) adoption of appropriate treatment of heavy charged particle and electron slowing down in matter;

(3) determination of the spatial energy deposition rates resulting from the interactions of neutrons with matter;

(4) calculation of the spatial energy deposition rates resulting from the various interactions of photons with matter;

(5) presentation of the results of such computations, including verification, validation, and specification of uncertainty.

NOTE: Lists do not start with a capital letter since not a full sentence.

4 Requirements of this standard

Compliance with this standard shall be demonstrated by meeting the following requirements:

(1) *Test program:* Have ability to accurately confirm the required physics characteristics listed in Table 1;

(2) *Test methods:* Perform each test using a documented and well-supported procedure (examples are given in the appendix);

(3) *Test acceptance:* Compare the results of each test to predetermined test criteria;

(4) *Test documentation:* Document the results of the test program including, at a minimum, the following items:

(a) the test methods employed,

(b) the measured parameters, including initial conditions,

(c) the predicted parameters and any corrections made to account for different core conditions,

(d) the predetermined test criteria for test acceptance,

(e) an evaluation of the test results based on a comparison between the measured and predicted parameters, taking into account the uncertainties in both the measurements and predictions.

A minimum of two reactivity control systems or means shall provide

This clause does not end with a colon since it does not use the words "the following" or "below".

(1) A means of inserting negative reactivity at a sufficient rate and amount to assure, with appropriate margin for malfunctions, that the design limits for the fission product barriers are not exceeded and safe shutdown is achieved and maintained during normal operation, including anticipated operational occurrences.

(2) A means that is independent and diverse from the other(s) and shall be capable of controlling the rate of reactivity changes resulting from planned, normal power changes to assure that the design limits for the fission product barriers are not exceeded.

(3) A means of inserting negative reactivity at a sufficient rate and amount to assure, with appropriate margin for malfunctions, that the capability to cool the fuel salt is maintained and a means of

NOTE: The lists start with a capital letter because they are full sentences.

shutting down the reactor and maintaining, at a minimum, a safe shutdown condition following a postulated accident.

(4) A means for holding the reactor in safe shutdown under conditions that allow for interventions such as fuel loading, inspection, and repair.

5 Summary of requirements of this standard

Compliance with the intent of this standard shall be demonstrated for an intended area of applicability of the calculational system used by meeting the following requirements:

(1) *Source distribution:* Neutron reaction rate distributions and photon and beta particle emitter distributions are to be obtained from calculations made in accordance with ANSI/ANS-1.22-2025 [2] or similar applicable standard (see Sec. 4.1 of this standard). Data are to be found in accordance with ANSI/ANS-1.21-2024 [6] or equivalent standard (see Sec. 4.5.1 of this standard);

(2) *List of physical phenomena:* All phenomena listed in Table 1 are to be considered and their treatment justified. Acceptable justification for method approximations may be degree of rigor, conservatism, or increased margin incorporated in design (see Sec. 4.6 of this standard);

(3) *Verification and validation:* The method of analysis is to be validated against experiments or verified with more rigorous and well-established analytical methods (see Sec. 5.2 of this standard);

(4) *Evaluation of accuracy:* The accuracy and range of applicability of data and methods are to be evaluated by establishment of biases and uncertainties, with degree of confidence, for the calculations, including allowance for uncertainties in the comparison data (see Sec. 5.3 of this standard);

(5) *Documentation:* Details of the above procedures are to be documented (see Sec. 6 of this standard).

6 Location to fuel

The following are examples of bulleted lists

The locations of the source and detectors relative to the fuel are important considerations [2].

- According to [2], “In the event an internal source is not practicable, the shape of the inverse multiplication curves will depend markedly on the source counter relationships. Extreme convex shapes are to be expected if the source and the detector are on the same side of the assembly and concave curves if the source and detector are on opposite sides. The latter is to be preferred from [a] safe operations standpoint, since conservative estimates will be obtained for the critical mass, i.e., the actual value will be larger than predicted during the approach-to-criticality”;
- According to Regulatory Guide 1.68 [3], “Nuclear instruments should be calibrated. A neutron count rate (of at least 1/2 counts per second) should register on startup channels before the startup begins, and the signal to noise ratio should be known to be greater than 2. A conservative startup rate limit (no shorter than approximately a 30-second period) should be established. High flux scram trips should be set at their lowest value”;
- Fuel loading should be started at locations where neutron count rates are largest to obtain a sufficient count rate, and then close to the control elements to maximize rod worth for safety considerations. Care should be taken to ensure that changes in measure count rates are due to reactivity additions, not from flux distortions imposed by the loading pattern. Adapted from [4].

7 Responsibilities

Those personnel whose responsibilities directly impact and are impacted by fissionable material operations. Examples include (but are not limited to) the following:

- building/facility custodial staff;
- construction personnel;
- decommissioning personnel;
- emergency planners/responders;
- equipment fabricators;
- firefighters;
- maintenance personnel;
- material accountants;
- nondestructive assay personnel;
- nuclear criticality safety representatives or officers;
- nuclear material custodians;
- other safety personnel;
- radiological control technicians;
- security personnel;
- transport personnel.

Bulleted list with only a few words may be in single space.

A.8 Tables

Tables are numbered numerically in the order in which they appear in the standard. The table number and table title are separated by an en-dash.

-Table titles precede tables
-Only first word of table title capitalized unless proper noun
-11 pt Times New Roman bold for table titles
-6 pt space after table title before the first row

Table 1 – Phenomena to be considered

(1) Fission
  (a) Kinetic energy of fission products
  (b) Prompt and decay beta particle energy

(2) Neutron capture
  (a) Kinetic energy of charged particles
  (b) Decay beta particle energy
  (c) Nuclear recoil

(3) Neutron scattering
  (a) Nuclear recoil following elastic scattering interactions
  (b) Nuclear recoil following inelastic scattering and subsequent nuclear de-excitation

(4) Photon sources
  (a) Prompt fission
  (b) Fission product decay
  (c) Neutron capture
  (d) Inelastic scatter de-excitation
  (e) Transmutation product decay
  (f) Positron annihilation
  (g) Bremsstrahlung
  (h) Atomic de-excitation

(5) Photon transport
  (a) Prompt fission
  (b) Fission product decay

10.5 pt Times New Roman for text inside tables but may be smaller to fit table on page.

Only first word capitalized unless a proper noun.

Table 2 – Energy deposition calculation results for VERA problem specification 2b

	CASMO5[a] (ENDF/B-VII.1)	MCNP[b] (ENDF/B-VII.1)	MPACT[c] (ENDF/B-VII.1)	Serpent 2[d] (ENDF/B-VII.1)	Serpent 2[d] (ENDF/B-VIII.0)
	Full-core recoverable energy per combine fission event (MeV)				
	199.1	199.37 ± 0.02	199.63	199.225 ± 0.006	199.817 ± 0.004
Material	**Percentage of total energy deposited in each material (%)**				
Fuel	96.96	96.93 ± 0.01	96.73	96.9227 ± 0.0000	96.8920 ± 0.0000
Cladding	0.87	0.90 ± 0.00	1.17	0.9049 ± 0.0002	0.9405 ± 0.0002
Coolant	2.17	2.17 ± 0.00	2.10	2.1723 ± 0.0002	2.1675 ± 0.0002

[a][26]
[b][13], [17]
[c][22]
[d][13]

Notes in tables are superscript lowercase letters.

Reference numbers added if applicable in the order in which they appear in the text.

Notes are boxed as the last row of the table.

NOTE: This table covers two pages. "(Cont'd)" is included in the title on the next page.

Table 3 – Required physics parameters to be confirmed

Characteristics	Example measured parameters used for confirmation	Testing requirements and recommendations
Core reactivity, including fuel loading	Critical fuel loading	Shall be determined using 1/*M* extrapolation.
	Integral and differential control element worth	Shall be measured at zero power and appropriate higher powers.
	Critical control element positions	Shall be measured at relevant reactor statepoints.
	Excess reactivity	Shall be determined at zero power.
	Reactivity deficit (HZP to HFP)	Shall be determined at full power (if applicable).
	Prompt and delayed neutron parameters	Shall be measured for systems with flowing fuel.
	Neutron lifetime	Shall be measured at zero power and at higher relevant powers.
	Control element worth interference (shadowing)	Shall be measured individually and in groups as appropriate.
Reactor shutdown	Shutdown margin	Shall be determined from measurements of excess reactivity and control element worth at cold and hot zero power and at higher powers, if appropriate.
Reactivity control	Isothermal temperature coefficient	Shall be measured, if applicable to safety.
	Power coefficient of reactivity	Shall be measured at power levels above the point of adding heat.
	Prompt and delayed component temperature coefficients	Should be measured when important to system performance.
	Coolant void coefficient	Should be measured if important to system performance.
	Reactor stability during transient reactivity events	Shall be demonstrated at zero power and higher relevant power levels.
	Reactivity response during pump startup and coastdown	Should be measured at several power levels, including full power, if applicable to safe operation.
	Load following	Should be measured at full and partial power, if a design requirement.
Power, temperature, and flow distribution	Power or flux distributions	Shall be measured at zero and higher powers if applicable to safety.
	Natural circulation	Shall be measured from zero power if required for normal operation and anticipated operational occurrences. The transition to natural circulation shall be evaluated at low power with heat rejection through the secondary or power conversion system.
	Flow distribution	Shall be measured if applicable to safety.
	Temperature distribution	Should be measured when important to system performance.

NOTE: Only first word capitalized.

The word "(Cont'd) is added for a continuation of this table.

Table 3 – Required physics parameters to be confirmed (Cont'd)

Characteristics	Example measured parameters used for confirmation	Testing requirements and recommendations
Reactivity control	Isothermal temperature coefficient	Shall be measured, if applicable to safety.
	Power coefficient of reactivity	Shall be measured at power levels above the point of adding heat.
	Prompt and delayed component temperature coefficients	Should be measured when important to system performance.
	Coolant void coefficient	Should be measured if important to system performance.
	Reactor stability during transient reactivity events	Shall be demonstrated at zero power and higher relevant power levels.
	Reactivity response during pump startup and coastdown	Should be measured at several power levels, including full power, if applicable to safe operation.
	Load following	Should be measured at full and partial power, if a design requirement.
Core reactivity, including fuel loading	Critical fuel loading	Shall be determined using $1/M$ extrapolation.
	Integral and differential control element worth	Shall be measured at zero power and appropriate higher powers.
	Critical control element positions	Shall be measured at relevant reactor statepoints.
	Excess reactivity	Shall be determined at zero power.
	Reactivity deficit (HZP to HFP)	Shall be determined at full power (if applicable).
	Prompt and delayed neutron parameters	Shall be measured for systems with flowing fuel.
	Neutron lifetime	Shall be measured at zero power and at higher relevant powers.
	Control element worth interference (shadowing)	Shall be measured individually and in groups as appropriate.

Tables in appendices include the appendix letter. The below recognizes that the table is the 4th table in Appendix B.

Table B.4 – Joint frequency distribution of wind direction, wind speed, and atmospheric turbulence

Period of Record: [beginning month/day/year—ending month/day/year]

If tables are wide, they may be placed landscape.

Extremely Unstable ($\Delta T/\Delta Z \leq -1.9°C/100$ m)[a)]
Pasquill Stability Class A

Wind Speed (ms^{-1}) at 10-m Level[b)]

Wind direction sector	**<0.5[c)]**	**0.5–1**	**1.1–2**	**2.1–3**	**3.1–4**	**4.1–5**	**5.1–6**	**6.1–8**	**8.1–10**	**10.1–13**	**13.1–18**	**>18**	**Total**
N													
NNE													
NE													
ENE													
E													
ESE													
SE													
SSE													
S													
SSW													
SW													
WSW													
W													
WNW													
NW													
NNW													
Total													
Number of calms[d)]													
Number of missing hours													

[a)] This stability classification is based on delta temperature and is provided as an example only for an A stability class. See Appendix B for further information on stability classifications and applicable references.

[b)] Values in this table can be in counts or percentage of hours.

[c)] This table applies to wind speeds resolved to the nearest 0.1 ms^{-1}. These wind speed classes are provided as an example only; other ranges may be needed in the joint frequency distribution (e.g., tighter ranges at the lower wind speeds used in radiological and toxic chemical air dispersion modeling [52]).

[d)] See definition of calm in Sec. 2 and see [10] for treatment of calms.

A.9 Figures

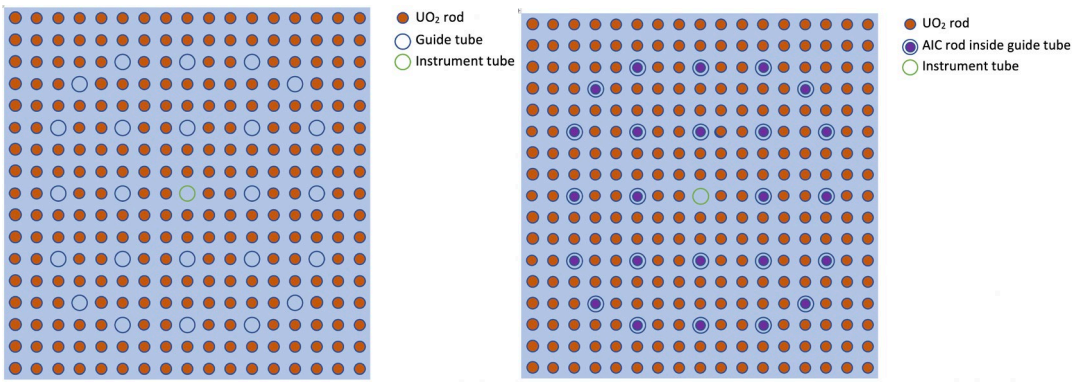

Figure 1 – 2D representations of the W17×17 fuel assembly for VERA problem specification (a) 2b and (b) 2g

Titles for figures are placed below the figure in 11 pt. Times New Roman bold.

The figure number and title are separated by an en-dash.

Figures are numbered in the order in which they appear in the text.

If the figure is in an appendix, the appendix letter should be included a part of the number.

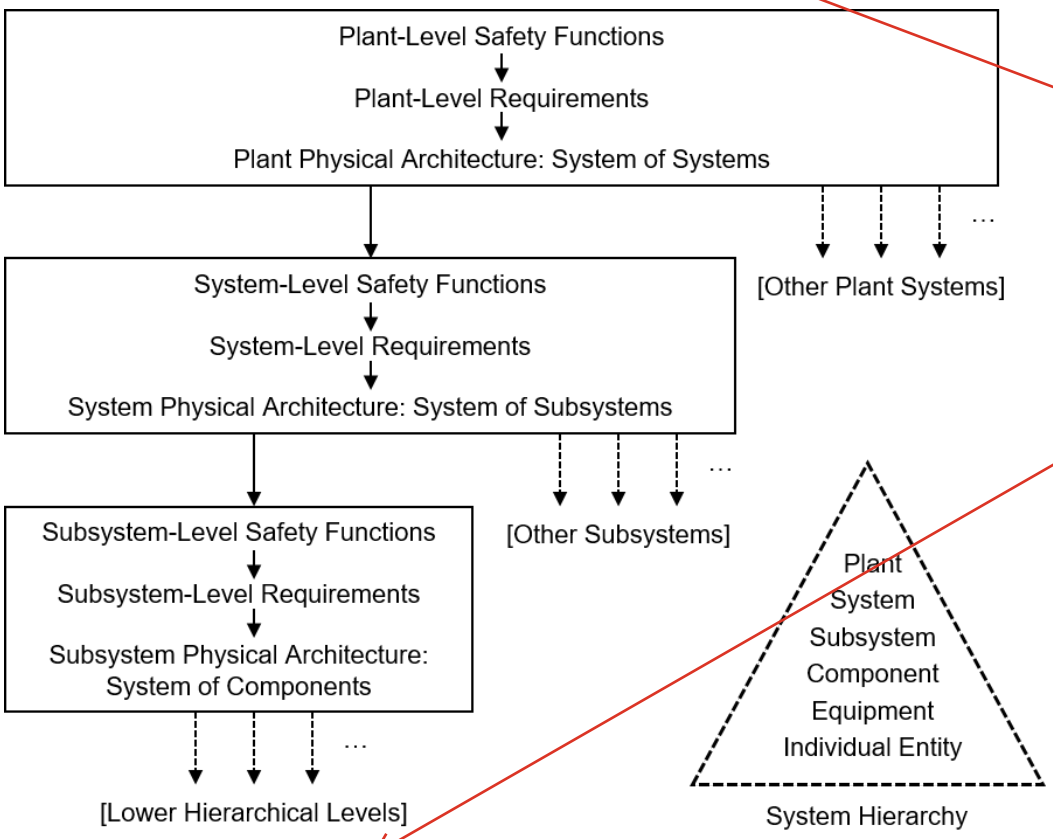

Figure A.1 – Relationship structure for safety functions, safety requirements, and physical architecture

A.10 Equations

Equations centered

The synthesized flux is given by

$$\phi(r,\theta,z) = \frac{\phi(r,\theta)\cdot\phi(r,z)}{\phi(r)} \qquad \text{(Eq. 1)}$$

The synthesis method is applicable when the primary region of interest is near the core midplane, and within this region the axial source distribution is relatively flat. Henceforth, one may consider separation of the r and θ variables, i.e., the azimuthal distribution does change axially, and hence the synthesis methods result in accurate solutions within the acceptable tolerance (i.e., $\pm$20%). Note that in regions beyond the core midplane in which the axial source and/or materials distributions vary significantly, the synthesis method yields erroneous solutions.

When fast neutron flux reduction core loading programs such as part-length hafnium absorber rods or stainless-steel flux suppression rods are utilized, the multi-channel analysis form of the 3D synthesis equation should be used,

$$\phi(r,\theta,z) = \phi_A(r,\theta) * \frac{\phi_A(r,z)}{\phi_A(r)} + \phi_B(r,\theta) * \frac{\phi_B(r,z)}{\phi_B(r)} \qquad \text{(Eq. 2)}$$

Equations numbered using the abbreviation "Eq." on line following the equation in parentheses.

Where the first term, denoted as channel "*A*", represents all assemblies in the core except for containing flux reduction feature; and the second term, referred to as channel "*B*" only represents the assemblies on the core peripheral that contain the flux reduction feature. A flow-chart for the synthesis deterministic transport method is provided in Fig. 1 of RG 1.190 [5].

For an observed set of wind speed samples u_i, the scalar mean wind speed $\bar{u}_s$ is defined as

where N is the number of valid samples in the averaging period. In determining the scalar mean wind direction $\bar{\theta}_s$, standard statistical methods for linear datasets are difficult to implement because wind direction is a circular function with a crossover point at 360 or 0 deg. For example, it is possible when using digital data to incorrectly average 1 deg and 359 deg (both north winds) and get 180 deg (i.e., south wind). As such, special care is required when calculating mean wind direction values.

The scalar mean wind direction $\bar{\theta}_s$ can be approximated by the unit vector wind direction [D.1][D.2] that is, by the arctangent of the mean sine and mean cosine of the valid wind direction samples in the averaging period, where the mean sine and mean cosine are defined as

$$\overline{\sin\theta} = \frac{1}{N}\sum_{i=1}^{N}\sin\theta_i \; ;$$

$$\overline{\cos\theta} = \frac{1}{N}\sum_{i=1}^{N}\cos\theta_i . \qquad \text{(Eq. D.1)}$$

Equations in appendices include the letter of the appendix. The above equation recognizes that it is the 1st equation in Appendix D.

26 pt font Times New Roman
If there is only one appendix, the appendix does not need to include a letter.

Appendix

20 pt line space

(This appendix does not contain any requirements of American National Standard ANSI/ANS-1.23-2025, *Insert Title of Standard,* but is included for informational purposes.)

9 pt font Times New Roman

Sections in appendices should include a letter. The first appendix includes "A" in the section number.

User's Guide

A.1 Introduction

The purpose of this appendix (User's Guide) is to provide the users of this standard a set of acceptable methods, general guidelines, precautions, and suggestions for each test. This appendix provides references to historical information that may assist in criterion development. Users are encouraged to develop their own test criteria based on expected differences between measurements and predictions. This appendix is not a set of requirements, nor should it be used as a detailed procedure for performing each test.

11 pt font Times New Roman

14 pt font Times New Roman Bold with 11 pt space after

A.2 Acronyms and definitions

A.2.1 Acronyms

1/*M*: inverse multiplication
ARO: all rods out
BWR: boiling water reactor
DPM: decades per minute
FOAK: first of a kind
HZP: hot zero power
I&C: instrumentation and control
RCS: reactor coolant system
SDM: shutdown margin
THTR: Thorium High Temperature Reactor
ZPTF: zero power transfer function

Most appendices are small and do not need an acronym list. Should you have a long appendix that uses more than 5 acronyms, an acronym section should be added.

Should an appendix use terms that that need to be defined, the definitions should be included in the appendix, not the main body of the standard.

A.2.2 Definitions

all rods out (ARO): All full-length control rods (elements) withdrawn (part-length rods may be inserted).

control element: One or more reactivity control members (rods, blades, or drums) mechanically attached to a single fixture.

inverse multiplication (1/*M*): The relationship between the neutron reproduction factor, k_{eff}, and neutron population multiplication, M. As the reactor approaches criticality, k_{eff} approaches unity, $1-k_{eff}$ approaches zero, and M grows as $1-k_{eff} = 1/M$.

ppm: parts per million (by weight). One part per millions is equivalent to one milligram of material per kilogram of solution.

regulating control rod group: A group of control rods that may be partially or fully inserted in the core during normal operation.

A.3 Test criteria

The use of criteria for evaluation of test results is a long-standing practice in industry. This method allows for on-the-spot evaluation of the test results against the nuclear design predictions. The ideal criterion to be used is tight enough such that no design anomaly would go unnoticed but loose enough such that typical differences would not violate the criterion. Some of the factors that enter into the determination of the criteria are the design model limitations, the measurement limitations, and the compatibility between the design and measurement methods. The criteria are essentially differences between predictions and measurements that would suggest a problem with the as-built core, the measurement, or the prediction.

All documents in an appendix should be cited. The first time the alphanumeric is used, a footnote is needed to explain. A separate References Section is needed should the appendix cite any documents. The reference number includes a letter to indicate

A.4 Acceptable test methods

INL/RPT-24-76187 [A.1][1)] and its numerous references provide detailed startup test program information that may be helpful in planning FOAK test programs.

It is important to note that for FOAK startups, reliance on a reactivity computer should be minimal until the reactivity parameters for the FOAK core are validated.

Subsequent to achieving initial criticality, the worth of the items controlling reactivity may be determined

A.5 General evaluation of test results

Startup physics testing is carried out to help verify that the reactor core can be operated as intended. The results of these tests can also be used to demonstrate that the design models used to predict the behavior of the core continue to be consistent with the measured data.

A separate References Section needs to be completed if any documents are cited in an appendix. The appendix does not rely on the References Section in the main body.

A.6 References

[A.1] INL/RPT-24-76187, S. E. BAYS et al., *Startup Physics Testing of Advanced Reactors: A Survey of Historical Practices*, Idaho National Laboratory (2024); https://www.osti.gov/biblio/2284092.

Numbering of footnotes start back at 1 in each appendix.

[1)] Alphanumerics in brackets refer to the corresponding alphanumerics in Sec. A.6, “References.”