

ANS Standards Style Manual

ANS Standards Style Manual 1st Edition



ANS Standards

American Nuclear Society



ANS Standards Style Manual 1st Edition

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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.

This manual incorporates guidance from the 1991 "Style Manual for Preparation of Proposed American National Standards" issued by the ANSI that remains valid and format and style criteria specific for ANS standards. 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 9 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

Section	Page
1 Scope, purpose, and application.....	1
1.1 Scope.....	1
1.2 Purpose.....	1
1.3 Application.....	1
2 Editorial responsibilities and policies.....	1
2.1 Technical contact's responsibility.....	1
2.2 Role of the ANS Publications Department.....	2
2.3 Responsibility of ANS's editor with regard to the technical contact.....	2
2.4 Policy on editorial and substantive changes.....	2
2.4.1 Substantive change defined.....	2
2.4.2 Policy.....	2
2.5 Editorial functions.....	3
2.6 Final check.....	3
3 Definitions.....	3
4 Format, style, and structure for specific standard elements.....	4
4.1 Elements of a published standard.....	4
4.2 General style.....	5
4.3 Capitalization.....	5
4.4 Page layout and fonts.....	5
4.4.1 Cover.....	5
4.4.2 Title page.....	5
4.4.3 Copyright page.....	6
4.4.4 Inquiry page.....	6
4.4.5 Foreword.....	7
4.4.6 Table of contents.....	7
4.4.7 Main text (body of the standard).....	8
4.4.8 Appendices.....	8
4.4.9 Tables and figures.....	9
5 Contents of standards elements.....	9
5.1 Foreword.....	9
5.1.1 Required statements.....	9
5.1.2 Committee rosters.....	10
5.2 Title.....	11
5.3 Main text (body of standard).....	11
5.3.1 Organization and numbering system.....	11
6 Special elements.....	17
6.1 Mathematical expressions (equations).....	17
6.1.1 General.....	17
6.1.2 Type specifications and spacing.....	17
6.1.3 Indentation and division of equations.....	18
6.1.4 Equations as parts of sentences.....	18
6.1.5 Numbering.....	18
6.1.6 Presentation of complex fractions.....	18
6.2 Lists.....	18
6.2.1 Format of introduction to list.....	18
6.2.2 Introducing a list member.....	19
6.2.3 Capitalization and punctuation of lists.....	19
6.2.4 References to lists.....	21

6.3	Notes.....	21
6.3.1	General.....	21
6.3.2	References to notes	21
6.4	Footnotes	21
6.4.1	Usage	21
6.4.2	Numbering	22
6.5	Subscripts and superscripts.....	22
7	General content and style	22
7.1	Spelling.....	22
7.2	Hyphenation	22
7.2.1	Usage	22
7.2.2	General hyphen and dash usage.....	22
7.3	Capitalization.....	23
7.3.1	General.....	23
7.3.2	Heads, table titles, table elements, figure titles, and figure callouts	23
7.3.3	Cross-references.....	23
7.4	Numbers	23
7.4.1	General usage.....	23
7.4.2	Use of a decimal point	24
7.4.3	Separation of numbers	24
7.4.4	Tolerances.....	24
7.5	Abbreviations	24
7.5.1	Usage	25
7.5.2	Presentation.....	25
7.6	Letter symbols for units.....	25
7.6.1	Usage	25
7.6.2	Form.....	25
7.7	Letter symbols for physical quantities.....	25
7.8	Special word usage	25
7.8.1	“Shall” and “should”.....	25
7.8.2	“And/or”	27
7.8.3	“That” and “which”	27
7.8.4	Nouns and adjectives	27
7.8.5	Nontechnical expressions.....	27
7.9	Metric and customary units	27
8	Values Cited	27
9	Special ANSI policies	27
9.1	Patented Items	27
9.2	Commercial equipment	28
9.3	Effective dates	28
9.4	Placement of tables and figures relative to text	28
9.4.1	Interspersing.....	28
9.4.2	Following main text.....	29
9.4.3	Table of contents.....	29
Appendix		
Appendix	Sample Standards Elements	30

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 will help speed up ANS's publishing process, thus condensing the time required between American National Standards Institute (ANSI) approval and public availability of the standard.

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. Volunteers who develop standards; however, 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 the production of a standard 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. 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 proof read the document and, where necessary, make corrections in:

- 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 for 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;
- title page;
- copyright page;
- inquiry page;
- foreword which includes the consensus committee roster, subcommittee roster, and working group roster
- table of contents;
- main text (body of standard) , including:
 - introduction (optional);
 - scope, purpose, and application;
 - acronyms and definitions (as applicable);
 - requirements;
 - tables, if any;

- figures, if any;
- references;
- appendices, if any; (includes bibliography)

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-201x" 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

- Designation flush top right in Trade Gothic 20 point bold font
- ANS logo
- Title flush left in Trade Gothic 14 point bold font
- The words "An American National Standard" in Trade Gothic 18 point font
- The publisher information/address flushed right at the bottom margin in Trade Gothic 11 point font
- Designation placed vertically at left margin in Trade Gothic 14 point bold font

4.4.2 Title page

- Designation in Arial 12 point bold font
- American National Standard and title in Arial 15 point bold font
- Secretariat information in Times New Roman 11 point font; 2nd line bold
- Working group information in Times New Roman 11 point font; 2nd through 4th line bold
- Publisher information in Times New Roman 11 point font; 2nd through 4th line bold

- Approval information Times New Roman 11 point font; 3rd line bold
- No header
- Unnumbered page

4.4.3 Copyright page

- 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 10 point font followed by 20 point space
- Publisher information in Times New Roman 12 point bold font
- Warning graphic
- Copyright statement; 1st line in Times New Roman 11 point bold font; 2nd line in Times New Roman 10 point font
- Reproduction disclaimer in Times New Roman 9 point font
- The phrase “Printed in the United States of America” in Times New Roman 10 point font
- Header “American National Standard ANSI/ANS-X.X-201x”
- Unnumbered page

4.4.4 Inquiry page

- 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-201x”
- Unnumbered page

4.4.5 Foreword

- 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-201x”
- Page numbered “i” and centered in footer

4.4.6 Table of contents

- 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” 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)

- 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 (Sec. 1, Sec. 2, Sec. 3)
 - 11 point space after section headings/before section
 - 11 point bold font for subsection headings (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

- 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 (“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

- 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

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 not part of the 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 is not a part of American National Standard [“title”], ANSI/ANS-X-XX-201x, but is included for informational purposes only.)

The following two statements shall be included in the foreword of all new, revised, or reaffirmed standards. The second statement shall be incorporated into those standards where the application of risk-

informed insights, performance-based requirements, or a graded approach to quality assurance is appropriate. If one or more of these three elements is addressed in the standard, that portion of the statement shall be deleted. If the working group determines that this statement is not relevant to the subject included in the standard, the entire statement may be eliminated, but only with the written concurrence of the consensus committee chair. (See the [ANS Standards Committee Procedures Manual for Consensus Committees](#) in the [Toolkit for ANS Standards Development and Maintenance](#))

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

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

5.1.2 Committee rosters

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 Publications Department 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)

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 (for example, Sec. 5.1). This subsection, in turn, may be subdivided by a second period and a second sequential number (for example, 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 (for example, 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 40 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

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 and definitions in Section 2

Acronyms 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 in parenthesis in the first use followed by the use of the acronym alone in subsequent uses. A list of acronyms shall be prepared if more than five acronyms are used.

The definition for “shall, should, and may” shall be include 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

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 (Continued)”
- 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 sent before footnotes.

5.3.1.5 References and excerpts

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.

Any document cited in the main text 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 with a corresponding number in the References Section with the full citation. 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-19.6.1-2011 (R2016), EPRI NP-5223, Regulatory Guide 1.167]. 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 use of copyright materials be deemed necessary, the working group chair shall contact the ANS Scientific Publications Department 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, Washington, D.C.
- [2] H. KOUTS, Letter to B. RUSCHE, U.S. Nuclear Regulatory Commission (Apr. 6, 1976).
- [3] ANSI/ANS-59.2-1985 (withdrawn), “Safety Criteria for HVAC Systems Located Outside Primary Containment,” American Nuclear Society, La Grange Park, Illinois.
- [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 (R2017), “Safety and Pressure Integrity Classification Criteria for Light Water Reactors,” American Nuclear Society, La Grange Park, Illinois.
- [10] ACI 318-14, “Building Code Requirements for Structural Concrete,” American Concrete Institute, Detroit, Michigan.
- [11] ASCE/SEI 7-16, “Minimum Design Loads for Buildings and Other Structures,” American Society of Civil Engineers, Reston, Virginia.
- [12] ANSI/ASME NQA-1-2015, “Quality Assurance Requirements for Nuclear Facility Applications,” ASME International, New York, New York.
- [13] ASTM D5144-2008, “Standard Guide for Use of Protective Coating Standards in Nuclear Power Plants,” ASTM International, Philadelphia, Pennsylvania.
- [14] *ASME Boiler and Pressure Vessel Code*, Sec. III, “Rules for Construction of Nuclear Facility Components,” Division 1, “Metallic Components,” Part NF, “Supports,” Class 2, ASME International New York, New York (2015).

5.3.1.4 Appendices

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 alphabetically 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 is not a part of American National Standard “[Title]” ANSI/ANS-X.X-201x, but is included for information purposes only.)

Cleaning procedure for new cylinders

When the standard has more than one appendix:

Appendix A

(This appendix is not a part of American National Standard “[Title]” ANSI/ANS-X.X-201x, but is included for information purposes only.)

Cleaning procedure for new cylinders

Appendix B

(This appendix is not a part of American National Standard “[Title]” ANSI/ANS-X.X-201x, but is included for information purposes only.)

Method for decontaminating cylinders

The text of the appendix shall be organized and numbered as described in 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)

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.

See page 48 of the appendix for an example of a mathematical expression.

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 (\times , Alt+0215) should be used for multiplication operations instead of the letter x or a point (\bullet), 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

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.

See page 41 of the appendix for examples of lists.

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 hollow 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 63 of the appendix for a sample of a note.

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 45 of the appendix for an example of a footnote.

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 Sec. 7.3.2 through Sec. 7.3.4 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 \pm 1 inch, not 10 \pm 1 inch.) There should be a space on both sides of the plus/minus (\pm) 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 \pm 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, 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 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • it is recommended that • ought to • shall consider
should not	<ul style="list-style-type: none"> • it is not recommended that • ought not to be
EXPRESSING PERMISSIONS	
Correct Form	Do Not Use Other Wording to Express Recommendations such as:
May	<ul style="list-style-type: none"> • 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 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 the ANS Publications Department 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.

9 Special ANSI policies

9.1 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 [2018 ANSI Essential Requirements: Due process requirements for American National Standards](#)).

9.2 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.

9.3 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.

9.4 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.

9.4.1 Interspersing

9.4.1.1 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.

9.4.1.2 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.

9.4.1.3 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).

9.4.1.4 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.

9.4.2 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.

9.4.3 Table of contents

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

See page 37 of the appendix for a sample table of contents.

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 9 of the ANS Standards Style Manual. Examples start on the next page. No example of a cover is provided since the ANS Publications Department will insert the cover as part of the final proof before publication.

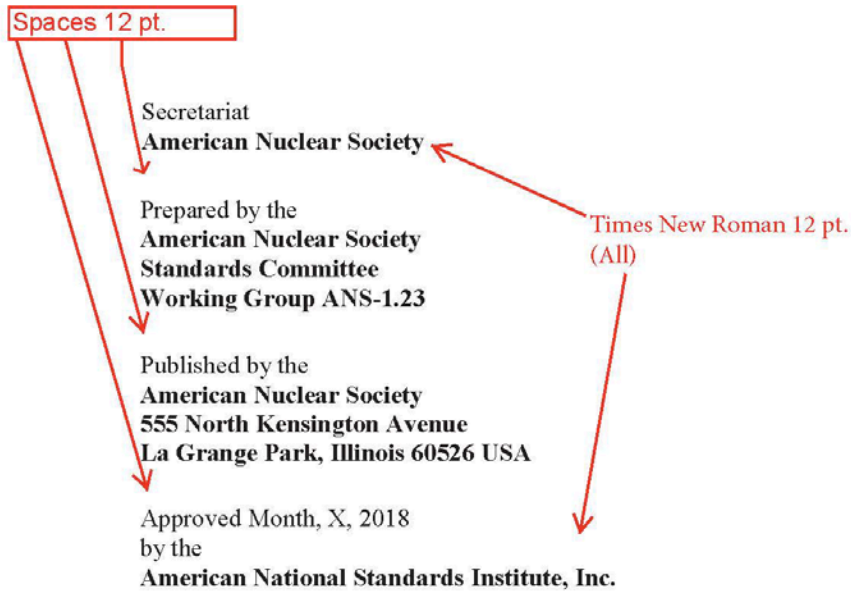
A.1 Title page

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

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

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

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



A.2 Copyright page

American National Standard ANSI/ANS-1.23-2018 ← This header must be on every page except the 1st page.
9pt. Times New Roman

**American
National
Standard**

↑
14 pt. Arial

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.

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. Responses to inquiries about requirements, recommendations, and/or permissive statements (i.e., "shall," "should," and "may," respectively) should be sent to the Standards Department at Society Headquarters. Action will be taken to provide appropriate response in accordance with established procedures that ensure consensus.

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

Published by ←

American Nuclear Society
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La Grange Park, Illinois 60526 USA

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A.3 Inquiry page

American National Standard ANSI/ANS-1.23-2018

Inquiry Requests

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Inquiry Format

The American Nuclear Society (ANS) Standards Committee will provide responses to inquiries about requirements, recommendations, and/or permissive statements (i.e., “shall,” “should,” and/or “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 on the ANS Web site or by contacting the ANS Publications Department.

Inquiry requests must 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 purposes 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: Publications Department
555 N. Kensington Avenue
La Grange Park, IL 60526

or standards@ans.org

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A.4 Foreword

American National Standard ANSI/ANS-1.23-2018

Foreword

14 pt.
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(This foreword is not a part of the American National Standard, "The Title of the Standard to be Entered Here," ANSI/ANS-1.23-2018.)

9 pt.
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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.

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American National Standard ANSI/ANS-1.23-2018

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pt. Times New
Roman.

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The ANS-1.23 Working Group was reconstituted in Month 200x to evaluate the currency of the 3-yr-old standard and to determine whether it should be simply reaffirmed on its Month X, 200x, sunset or whether it needed to be updated to account for new reference standards, advances in instrumentation, advances in data management equipment and techniques, advances in program management, integration with facility programs (e.g., configuration management), and other considerations. The working group unanimously determined to update the standard, and ANSI/ANS-1.23-200x is a result of this work. In 201x, the ANS-1.23 Working Group again reevaluated the actions to be taken on the standard prior to its 5-yr sunset in Month 201x. The working group unanimously determined to reaffirm the standard.

The ANS-1.23 Working Group was reconstituted in Month 201x to revise ANSI/ANS-1.23-200x (R201x). The revision is needed to account for new reference standards, advances in instrumentation, advances in data management equipment and techniques, advances in program management, improvements in integration with facility programs (e.g., configuration management), cyber security, software quality assurance, and other programmatic considerations. The appendices provide supplemental information needed for the design and implementation of the program.

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

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:

T. T. Smith (Cochair), *Organization*
J. B. Jones (Cochair), *Organization*

M. B. Apple, *Organization*
R. R. Basket, *Organization*
K. M. Burger, *Organization*
P. N. Carroll, *Organization*
M. O. Douglas, *Organization*
D. R. Eagle, *Individual*
K. Frank, *Organization*
W. E. Gooding, *Organization*
A. L. High, *Organization*
P. E. Jones, *Individual*
K. K. Kenney, *Organization*

Note: Rosters use initials for first and middle names (if known). Only the company name is in *italics*.

All type in 10.5 pt.
Times New Roman



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

L. M. Little (Chair), *Organization*

T. A. Biggert, *Organization*

J. C. Dingle, *Individual*

D. D. Kellern, *Organization*

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

C. D. Arlington (Chair), *Organization*

Y. A. Thomas (Vice Chair), *Organization*

T. Bellinger, *Organization*

K. Bryson, *Individual*

J. Cullet, *Organization*

R. Davidson, *Organization*

Q. Effingham, *Organization*

R. J. Gates, *Organization*

J. O. House, *Organization*

L. Jeffers, *Organization*

T. Kensington, *Organization*

J. Morriety, *Individual*

S. A. Rogers, *Organization*

J. Williams, *Organization*

A.5 Table of contents

American National Standard ANSI/ANS-1.23-2018

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Contents

Section ← 14 pt. Times New Roman Bold → Page

1	Introduction and scope.....	1
1.1	Introduction.....	1
1.2	Scope.....	1
2	Acronyms and definitions	1
2.1	Acronyms.....	1
2.2	Shall, should, and may	1
2.3	Definitions.....	1
3	Computer code system.....	2
4	Selection and modeling of benchmarks	3
5	Establishment of bias, bias uncertainty, and margins	4
5.1	Methods and data	4
5.2	Trending.....	4
5.3	Weighting and rejection of data	5
5.4	Margin of subcriticality	5
6	Applicability of the validation	5
7	Documentation and independent technical review	6
8	References	7

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New
Roman

Appendices

Appendix A	Examples of Physical and Derived Parameters.....	8
Appendix B	Sources of Information on Experiments	10
Appendix C	Annotated Use in Validation of Computational Methods of Surveying Methodology	12
Appendix D	Bibliography.....	16

14 pt. Times
New Roman
Bold

Tables

Table D.1	Process parameters and data	17
Table D.2	Parameters of benchmark experiments	18
Table D.3	Calculation results for the benchmark experiments	19
Table D.4	Comparison of benchmark applicability and process parameters.....	20

Figures

Figure D.1	Benchmark results plotted against average lethargy energy causing fission	21
Figure D.2	Benchmark results plotted against mineral concentration	21
Figure D.3	Benchmark results plotted against moderation ratio	22
Figure D.4	Validation results showing the calculational margin and the margin of error.....	24

A.6 Main text

NOTE: This page starts the formal portion of the standard and numbering at # 1 (see below).

American National Standard ANSI/ANS-1.23-2018

Title of the Standard

Space = 20 pt.

1 Introduction and scope

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28 pt. Times New Roman

1.1 Introduction

This consensus standard provides criteria for gathering, assembling, processing, storing, and disseminating information at commercial nuclear electric generating stations. The standard was developed to provide criteria in these methods.

11 pt. Times New Roman for body of standard

1.2 Scope

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

Space = 20 pt. before Level 1 title

NOTE: Only first word in titles are capitalized unless they are a proper noun.

2 Acronyms and definitions

14 pt. Times New Roman for Level 1 title & space after

2.1 Acronyms

ABL:	atmospheric boundary layer
ASO:	Automated Surface Observing System
QA:	quality assurance
DQOs:	data quality objectives
FAA:	Federal Aviation Administration
HVAC:	heating ventilating and air conditioning
lidar:	light detection and ranging
MADIS:	Meteorological Assimilation Data Ingest System
NIST:	National Institute of Standards and Technology
NOAA:	National Oceanic and Atmospheric Administration
NEXRAD:	next generation weather radar
NWS:	National Weather Service
radar:	radio detection and ranging
RASS:	radio acoustic sounding system
SA:	system accuracy
sodar:	sound detection and ranging
SRDT:	Solar Radiation/Delta-T
TIBL:	thermal internal boundary layer
TKE:	turbulence kinetic energy

11 pt Times New Roman for body of standard including space before and after Level 2 titles.

2.2 Shall, should and may

The word "shall" is used to denote a requirement; the word "should" is used to denote a recommendation;

Numbering starts at 1

American National Standard ANSI/ANS-1.23-2018

With the exception of the header, this entire page is 11 pt. Times New Roman including spaces before and after the Level 2 title.

and the word “may” is used to denote permission, neither a requirement nor a recommendation.

2.3 Definitions

Terms start in lower case letters unless proper noun followed by a colon.

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

References numbered in brackets with full citation in the References Section.

atmospheric/barometric pressure: The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question [1].

atmospheric turbulence: Fluctuations occurring in all three velocity components and unpredictable in detail; however, statistically distinct properties of the turbulence can be identified and profitably analyzed. Turbulence exhibits a broad range of spatial and temporal scales resulting in efficient mixing of fluid properties [1].

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 US, calm is typically defined as any speed less than 1 mph.

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

damping: The more or less steady diminishing in time or space (or both) of the amplitude of any physical quantity.

damping ratio: Ratio of the actual damping, related to the inertial-driven overshoot of wind vanes to direction changes, to the critical damping, the fastest response where no overshoot occurs.

delay distance: The distance that air flowing past a wind vane moves while the vane is responding to 50% of the step change in the wind direction [2].

dew point temperature: The temperature to which a given air parcel must be cooled at constant pressure and constant water vapor content in order for saturation to occur [1].

gravity wave: A wave disturbance in which buoyancy acts as the restoring force on parcels displaced from hydrostatic equilibrium [1].

gust: According to U.S. weather observing practice, gusts are reported when the peak wind speed reaches at least 16 knots and the variation in wind speed between the peaks and lulls is at least 9 knots. The duration of a gust is usually less than 20 s [1].

horizontal wind direction: The direction from which the wind is blowing relative to the horizon. Values are reported in degrees azimuth measured clockwise from true north and ranging from 0 to <360 degrees azimuth (i.e., north is 0 degrees azimuth; east is 90 degrees azimuth; south is 180 degrees azimuth; west is 270 degrees azimuth).

horizontal wind speed: The ratio of the distance covered by the movement of air to the time taken to cover it relative to the horizon [1].

instrument system: All components from sensor to and including data recording and display. (Herein referred to as “system.”)

¹⁾Numbers in brackets refer to corresponding numbers in Section 9, “References.”

2

The first reference cited in the body of the standard must include a footnote to explain that numbers in brackets refer to corresponding numbers in the references section.

5 Selection and modeling of benchmarks

5.1

Subsection numbering stand alone on a line when no title is provided.

Appropriate system or process parameters that correlate the experiments to the system(s) or process(es) under consideration shall be identified. (See Appendix A for example physical and derived parameters.) Automated selection systems that consider the isotopes, their abundances, energy ranges, cross-section uncertainties, or other parameters may be used.

5.2

If the validation is being developed for a specific system(s) or process(es), normal and credible abnormal conditions for the system(s) or process(es) shall be identified when determining the appropriate parameters and their ranges of values. If the validation is more general in nature, the appropriateness of the validation shall be assessed and documented for the normal and credible abnormal conditions of the system(s) being evaluated.

5.3

Selected benchmarks should, in aggregate, encompass the appropriate parameter values spanning the range of normal and credible abnormal conditions for the system or process to which the validation will be applied.

5.4

Experiments shall be reviewed for completeness and accuracy of information prior to use as benchmarks. (See Appendix B for several sources of information on experiments.)

5.5

Benchmarks selected should be consistent with the modeling capabilities of the calculational method.

5.6

To minimize systematic error, benchmarks should be drawn from multiple, independent experimental series.

5.7

The calculational methods and analysis techniques used to analyze the set of benchmarks should be the same as those used to analyze the system or process to which the validation is applied or justification shall be provided for the different techniques.

5.8

Modeling of benchmarks shall be the responsibility of individuals experienced in the use of the computer code system.

5.9

Benchmark models prepared by organizations other than the one performing the validation should be evaluated to confirm the appropriateness of calculational methods and analysis techniques for the intended use.

A.7 Lists

American National Standard ANSI/ANS-1.23-2018

performing the gamma ray spectrometry. Detailed plant operating data should be available for the period of approximately five half-lives before the measurement in order to permit calculations of the fission product distribution for comparison with the measured distribution.

6.3.1 Specific data requirements

An example of numbered lists

- (1) Record gamma ray intensity for specified fuel rods or assemblies, including location, time, and element identification.
- (2) Measure the count rate loss characteristics of the system.
- (3) Determine the following by periodic counting of a fuel element selected as a standard:
 - (a) overall performance of the system and the accuracy of techniques used to account for background, count rate losses, and photopeak intensity calculations by comparison of observed half-life exhibited by the standard with the known half-life of the isotope being monitored.
 - (b) reproducibility of the measurements.
 - (c) changes in system sensitivity, i.e., drift.
- (4) Determine the energy calibration of the system by use of known gamma ray sources.

6.3.2 Additional Documentation

In addition to the information described in Sec. 7, the documentation should include:

- (1) A description of the experimental setup used to obtain the reported results. Include dimensioned sketches showing the relative locations and orientations of the gamma ray detector(s), collimators, shielding, and the fuel sample being measured.
- (2) A line diagram describing the operation of the system electronics.
- (3) A description of the gamma ray detector size, type, and efficiency.
- (4) A description of the measurements made and the data reduction procedures used to compute photopeak intensities, background, count rate losses, and decay factors.
- (5) Report the uncertainties associated with the component parts of the measurement as well as the overall measurement uncertainty. Present measurement data and best estimates of uncertainties made on the basis of past experience and engineering judgment.

7 Summary of reference measurement documentation

The primary objective of this documentation is to ensure that the information supplied is adequate to describe the measurements and sufficiently complete to enable one skilled in the practice of reactor design to validate and/or improve existing physics methods. A suggested format for the reference measurement documentation is attached in Appendix C.

American National Standard ANSI/ANS-1.23-2018

It is anticipated that the short-term actions described in this section would be completed by plant operators and other on-site personnel within about 8 hours after the earthquake. These actions are in addition to the operator actions that would be taken in response to a plant upset such as an earthquake in accordance with existing plant operating procedures, emergency operating procedures, alarm response procedures, the emergency plan, and other licensing requirements.

Short-term actions in response to an earthquake include the following:

- immediate operator actions to control the plant and to identify any abnormalities suspected to have been caused by the earthquake, including concomitant events such as earthquake-caused flooding, tsunamis, fire, off-site and on-site power failures, etc.;
- operator walkdown inspections of accessible areas of the nuclear power plant;
- evaluation of ground and structure motion records from installed seismic instruments and determination of whether or not the recorded motions and related parameters exceeded the OBE exceedance criterion;
- pre-shutdown inspections of essential safe shutdown equipment (to be performed prior to normal shutdown if normal shutdown is required).

These actions are described below.

6.1 Immediate operator actions

Example of bulleted lists shown with 11 pt spacing. Single word or short bulleted lists may be presented without line spacing between bulleted items.

It is expected that a felt earthquake with sufficient size to cause operating system upset and/or damage will result in alarms and/or changes in plant parameters that will require control room operators to respond to plant alarms and other immediate effects of the earthquake in accordance with approved plant operating procedures and emergency operating procedures. Operator response to maintain the safe, stable condition of the plant would take precedence over the earthquake-related inspections and evaluations described below. As part of the operator response to the earthquake, the following specific control room board checks should be made:

- primary coolant and secondary system radiation, temperature, pressure, and flow parameters for changes and excursions coincident with the earthquake. This includes sampling and analysis of primary and secondary coolant;
- primary coolant loose-parts monitoring system for changes in noise levels/signatures;
- control and/or instrumentation trips/upsets to SR and non-SR SSCs and any evidence of equipment and system malfunctions;
- spurious relay actuations;
- rotating equipment vibration monitoring sensors for changes;
- indications of fluid levels in important low-pressure storage tanks.

6.2 Operator walkdown inspections

Following a felt earthquake, as defined in Sec. 3, all accessible areas of the nuclear power plant shall be walked down and visually inspected by plant operators and available to on-site personnel who are familiar with the pre-earthquake physical condition of plant equipment and structures and the areas being inspected. High-radiation areas, the primary containment building, and other areas with limited access need not be included in these initial walkdown inspections unless plant personnel have reason to suspect that there may be damage in these areas. The purpose of these operator walkdown inspections is to determine the effects of the earthquake on the physical condition of nuclear plant equipment and

A.8 Tables

11 pt. Times New Roman

American National Standard ANSI/ANS-1.23-2018

Table 1 – Minimum system accuracy and resolution requirements

11 pt. space

This table provides values for a monitoring system using typical tower-mounted sensors and digital data processing systems.

Text in columns is left justified.

Measurement ^a	Unit ^b	Accuracy (\pm) ^c	Resolution ^d
Wind speed	meters per second	0.2 or 5% of observed wind speed	0.1
Standard Deviation of Wind speed			
Sigma-v (horizontal)	meters per second	n/a ^e	0.01
Sigma-w (vertical)	meters per second	n/a	0.01
Wind direction			
Horizontal	degrees azimuth	5	1.0
Vertical	degrees elevation	5	0.1
Standard deviation of horizontal wind direction fluctuations			
Sigma theta (or sigma-a)	degrees azimuth	n/a	0.1
Standard deviation of vertical wind direction fluctuations			
Sigma phi (or sigma-e)	degrees elevation	n/a	0.1
Air temperature	degrees Celsius	0.5	0.1
Vertical air temperature difference (delta T)	degrees Celsius	0.1	0.01
Dew point temperature	degrees Celsius	1.5	0.1
Wet-bulb temperature	degrees Celsius	0.5	0.1
Relative humidity	percent	4	0.1
Barometric pressure	millibars or hectopascals	3	0.1
Precipitation	millimeters	10% of volume ^f	0.25
Solar radiation	watts per square meter	10	1
Net radiation		5% of observed	1
Soil temperature	degrees Celsius	1	0.5
Soil moisture	percent	10% of actual	1
Time	minutes	5	1

10.5 pt. Times New Roman

^aFor measurements that are not listed, accuracy should be based on the manufacturer's guidance.

^bOther measurement units (e.g., miles per hour, degrees Fahrenheit, inches, hours) may be used to be consistent with monitoring program DQOs.

^cThese are both system accuracy and sensor accuracy values. The system accuracy encompasses all components impacting system accuracy (i.e., sensors, data processing equipment, computer, calibrations, etc.). The sensor accuracy applies to the manufacturer's instrument specification. If calculations described in 7.1 indicate that the system accuracy is not adequate, a sensor with accuracy better than that listed above may be required.

^dResolutions are based on the recommended units.

^en/a = not applicable

^fAccuracy is for volume equivalent to 2.54-mm (0.01-in) precipitation and rate <50 mm/h (2 in/h).

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Footnotes to tables should be enclosed/boxed at the end of the table.

23

Table 1 – Action level matrix (Continued)

"(Continued)" will be added in the publication process for tables that continue to the next page.

Damage level	Earthquake level		
	EL 1: ≤OBE	EL 2: >OBE, ≤SSE	EL 3: >SSE
DL 0: No damage to SR SSCs or non-SR SSCs important to safe plant operation. Damage limited to non-SR damage indicators that have no significant impact on plant operation and are typically found in residences, office buildings, etc.	No actions required	Action level 1	Action level 1
DL 1: No damage to SR SSCs; no damage to rugged industrial-type non-SR SSCs. Damage to non-SR SSCs not important to safe plant operation.	Action level 1	Action level 1	Action level 1
DL 2: No damage to SR SSCs; damage to rugged industrial-type non-SR SSCs. Damage to non-SR SSCs important to safe plant operation.	Action level 2	Action level 2	Action level 5
DL 3: Damage to many non-SR SSCs; slight/isolated damage to less rugged SR SSCs that does not affect equipment functionality.	Note 1	Action level 3	Action level 5
DL 4: Damage to SR and non-SR SSCs.	Note 1	Action level 4	Action level 6
Notes: 1. These combinations of DL and EL are highly unlikely; if they should occur, their occurrence suggests more significant problems than are addressed in the scope of this standard. 2. In addition to the cases covered in this table, attention should be given to earthquake scenarios involving high-frequency and low-frequency exceedances of SSE design spectra. See Sec. 7.3.			

An example of notes to a table.

8 Post-shutdown inspections and tests

The post-shutdown inspections and tests listed in the ALs shown in Table 1 are described below. It is intended that the evaluations performed under this section and any resulting repairs/replacements of SR SSCs would be performed, tracked, and documented under the plant’s approved CAP.

8.1 Focused inspections and tests

The focused inspections and tests are detailed, visual inspections and tests of a preselected sample of representative structures and equipment, as discussed in Sec. 5. The equipment and structures included in the focused inspections are selected to sample all types of SR and non-SR SSCs important to safe plant operation and include equipment and types of structures that are considered most likely to be damaged due to earthquake shaking. The focused inspections also include non-SR SSCs that experience has shown to be of low seismic capacity to serve as earthquake damage indicators. These inspections should be performed by experienced seismic engineers (e.g., experienced and/or trained in seismic design and qualification, experienced in the observation of earthquake damage to commercial SSCs, or equivalent) and plant operations personnel. The purpose of these inspections is to determine the need for expanded inspections and tests and to provide data to establish the earthquake DL defined in Sec. 7.

It may be necessary to position some tables in landscape.

American National Standard ANSI/ANS-1.23-2018

Table 2 – Frequency distribution of wind direction, wind speed, and atmospheric turbulence
 Period of Record: [beginning month/day/year—ending month/day/year]

Extremely Unstable ($\Delta T / \Delta Z < -1.9^\circ\text{C}/100\text{ m}$)^a
 Pasquill Stability Class A

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

Wind Direction Sector	≤ 0.5 ^c	0.5 to 1	1.1 to 2	2.1 to 3	3.1 to 4	4.1 to 5	5.1 to 6	6.1 to 8	8.1 to 10	10.1 to 13	13.1 to 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													

Footnotes in a table.

^aThis stability classification is based on delta temperature and provided as an example only for an Alpha stability class. See Appendix B for further information on stability classifications and applicable references.

^bValues in this table can be in counts or percentage of hours.

^cThis 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 for radiological and toxic chemical air dispersion modeling [54]).

^dSee definition of calm in Sec. 2, and [10] for treatment of calms.

A.9 Figures

American National Standard ANSI/ANS-1.23-2018

The above short-term actions that lead to the decision to shut down the plant are shown schematically in Fig. 1.

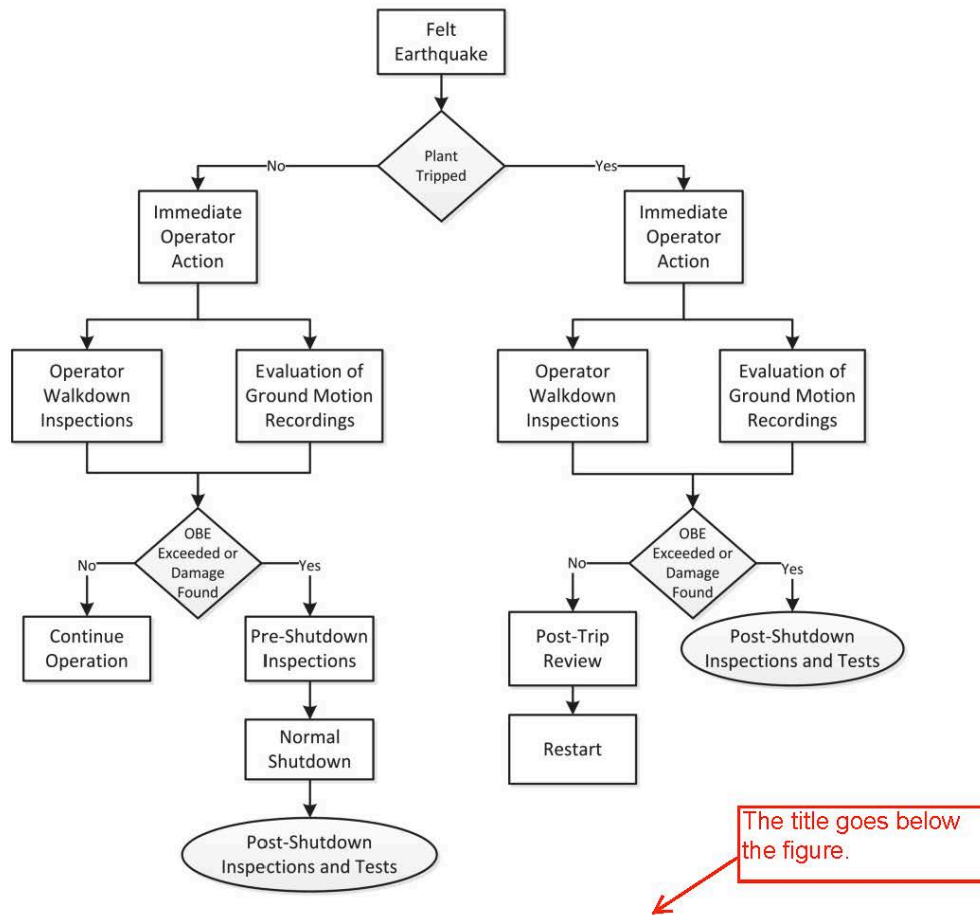


Figure 1 – Flow diagram of short-term actions

7 Earthquake response action levels

The short-term actions described in Sec. 6 for immediate response to a felt earthquake lead to a decision on the need for plant shutdown (or continued shutdown if the plant has tripped as a result of the earthquake) and for further focused and expanded inspections and tests intended to characterize the severity and damage potential of the earthquake. This section prescribes graded post-shutdown actions that are dependent on the observed DL and size of the earthquake (EL).

D.6 Trending of benchmark results (Section 6)

Using the benchmark parameter data, a search for possible trending was performed.²⁾ The data were plotted against various parameters as seen in Figs. D.1, D.2, and D.3, and preliminary curve fits were developed. For a first screening, the calculated k_{eff} values were not weighted or adjusted for statistical or experimental uncertainties.

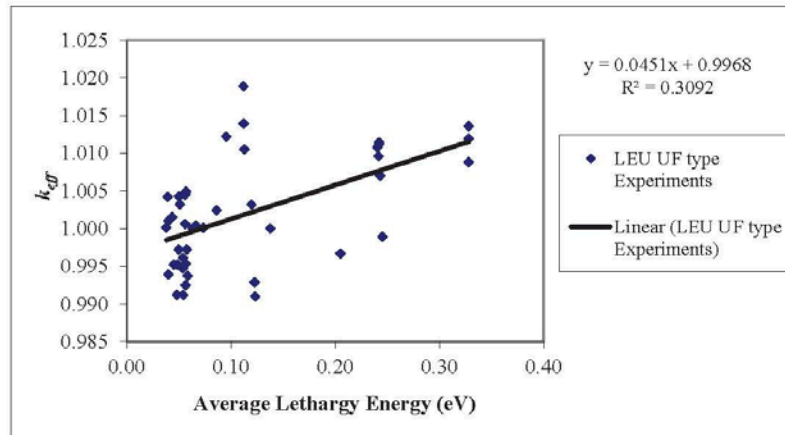


Figure D.1 – Benchmark results plotted against average lethargy energy causing fission
(note: different shapes of the neutron spectra can result in the same average value)

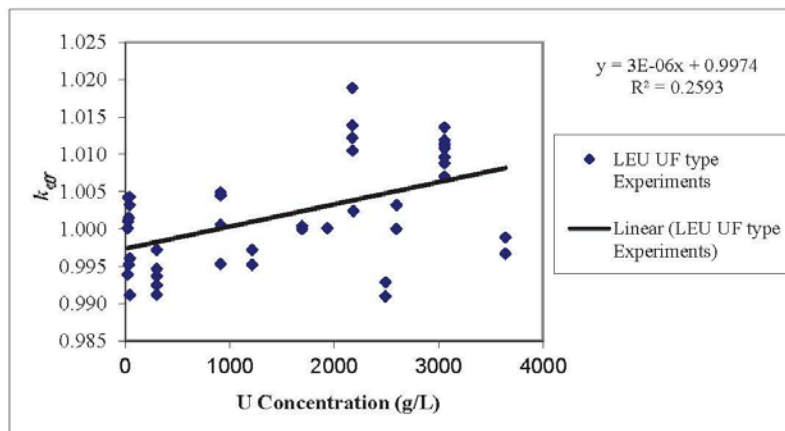


Figure D.2 – Benchmark results plotted against uranium concentration

²⁾ For the purpose of brevity in this example, not all parameters were plotted for trends.

A.9 Equations

American National Standard ANSI/ANS-1.23-2018

For a real measurement, the “nonideal” reactivity components are included in the numerator, and the measured TTC is

Equations centered →
$$\text{TTC}_{meas} = \frac{\Delta\rho_{boron} + \Delta\rho_{power} + \Delta\rho_{rods} + \Delta\rho_{AFD} + \Delta\rho_{Bu} + \Delta\rho_{xenon}}{\Delta T_{ave}} \quad (\text{Eq. 21})$$

Most of the reactivity terms in the numerator can be replaced by a calculated value, typically a precalculated coefficient multiplied by the measured change in the variable. If the “nonideal” terms are accurately calculated, the $\text{TTC}_{meas} = \text{TTC}_{ideal}$.

For the statepoint 1-2 calculation,

Equations numbered using the abbreviation Eq. on line following equation. →
$$\text{TTC}_{meas} = \frac{(\Delta B \times \text{DBW}) + (\Delta P \times \text{PDC}) + (\Delta H \times \text{DRW}) + (\Delta \text{AFD} - \Delta \text{AFD}_{ideal}) \times \alpha_{\text{AFD}} + (\Delta t \times \text{DEPC}) + (\Delta \text{Xe} \times \text{XEWC})}{\Delta T_{ave}} \quad (\text{Eq. 22})$$

where:

ΔB is the measured change in the soluble boron concentration (B);

DBW is the predicted differential boron worth value at HFP for the current burnup (negative quantity);

ΔP is the measured change in the heat balance power level (P);

PDC is the predicted power Doppler coefficient of reactivity (negative quantity);

ΔH is the measured change in control rod group position (H);

DRW is the predicted differential control rod worth for the regulating group at the measured core burnup;

ΔAFD is the measured change in AFD;

$\Delta \text{AFD}_{ideal}$ is the predicted change in AFD for a conventional HFP ITC calculated using the measured statepoint RCS temperatures;

α_{AFD} is the AFD reactivity coefficient [treated as an unknown in (Eq. 22)];

Δt is the measured change in midpoint in time (t);

DEPC is the predicted fuel depletion rate (pcm/hour) at HFP;

ΔXe is the calculated change in core-average xenon concentration (Xe);

XEWC is the predicted coefficient for xenon worth;

ΔT_{ave} is the measured change in the average RCS temperature from the initial state to the final state.

Note that Δ represents the change in the parameter from one statepoint to the next (e.g., $\Delta B = B_2 - B_1$).

All predicted values should be calculated at the current core burnup at equilibrium HFP conditions for an HFP measurement. Statepoint variables for the calculations of the change in reactivity due to boron, power, depletion, and control rod position are directly measured during the test and averaged for each statepoint. The correction for the change in xenon typically is calculated with a simple zero-dimensional xenon model using the detailed power history (power versus time, in 10- or 5-minute intervals) collected over the duration of the test.

A.10 Appendix

American National Standard ANSI/ANS-1.23-2018

Appendix A

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(This appendix is not a part of American National Standard “Title of Standard” ANSI/ANS-1.23- 2018, but is included for information purposes only.)

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The Cumulative Absolute Velocity Damage Parameter

The cumulative absolute velocity (CAV) is a parameter that is used to estimate on a conservative basis the potential for an observed earthquake to cause significant damage to conventional industrial equipment and structures. The background, definition, and use of the standardized CAV in the standard is presented below.

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A.1 Background

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& 11 pt. space after title

In 1987, the Electric Power Research Institute formed the Operating Basis Earthquake (OBE) Exceedance Panel (the Panel) to develop a criterion for determining whether the ground motion due to an earthquake at a nuclear power plant site exceeded that of the OBE. The objective of the criterion is to provide a technical basis for determining if the OBE has been exceeded based on *both* exceedance of the OBE seismic response spectrum *and* the damage potential of the earthquake and to avoid unnecessary shutdown of operating nuclear power plants following nondamaging earthquakes.

The Panel subsequently performed an extensive study of damage in commercial power plants and industrial facilities caused by earthquakes [A.1]¹⁾. This study concluded that the best predictor of earthquake damage to such commercial/industrial plants is a parameter referred to as the CAV. The definition and basis for the CAV are described below.

A.2 Cumulative absolute velocity

The CAV is defined as follows:

$$CAV = \int_0^{t_{\max}} a(t) dt,$$

(A.1)

where:

$a(t)$ = acceleration time history;

t_{\max} = duration of strong motion.

This parameter is the absolute area under the ground motion acceleration time-history accelerogram over the duration of the strong motion of an earthquake. This duration is defined based on subsequent work [A.2] and is used in the calculation of the “standardized CAV.” Correlation of the values of CAV with the onset of damage in the commercial and industrial plants in the study demonstrated that damage was not observed at standardized CAV values <0.16 g-seconds. Thus, the threshold of damage was set at this value. Ground motion measurements used for determination of the CAV are intended to be based only on free-field instruments, unless otherwise justified.

¹⁾ Numbers in brackets refer to corresponding alphanumeric listings in Sec. A.3, “References.”