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# Technical Writing Style Guide

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Compiled by: A. Savolainen, R. H. Feldmann, W. E. Oliu, M. H. Singh

Division of Technical Information and Document Control  
Office of Administration

U.S. Nuclear Regulatory  
Commission



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U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555**



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### ABSTRACT

This style guide provides recommended guidelines to NRC staff and contractors as they prepare draft and final staff and contractor documents. Detailed information on report content and organization is presented with examples.

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## PREFACE

This document provides recommended guidelines for the preparation of draft and final staff and contractor documents (see Glossary for definitions) for the U.S. Nuclear Regulatory Commission (NRC). Both the objectives and organization of technical reports are discussed. Use of the guidelines recommended in this guide will improve information exchange between contractors and the NRC staff, provide a uniform format to aid staff and contractors in preparing reports, and produce consistency in documentation procedures. Properly reported work serves as source material for NRC regulatory actions, and the report is a legal record of completion of contract requirements.

Guidelines presented in this document will help improve the readability of NRC reports. However, variations of these guidelines are also acceptable. Guidance presented here was adopted from national standards common to most technical publications. The ORNL Style Guide (May 1974) and LASL Technical Information Manual (April 1977) proved useful in the compilation of this NRC Technical Writing Style Guide.

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## ACKNOWLEDGMENTS

Many individuals contributed to this compilation through preparation of the initial draft and comments made during the review process. The initial draft was prepared by Leslie Casey, now of the Office of Nuclear Regulatory Research, and the following members of the Office of Nuclear Materials Site Safety and Safeguards: Nadia Dayem, Daniel Fehringer, Mark Grayson, Michael Kearney, Dave Rohrer, Stephen Schreurs, and George Wu. The comments of Edward L. Hill and Carol Peabody of the Office of Standards Development and William J. Maher of the Office of Management and Program Analysis were particularly helpful.

Appreciation is due to Walter Oliu and his colleagues who generously permitted use of material from their book "Handbook of Technical Writing," by Charles T. Brusaw, Gerald J. Alred, and Walter Oliu, St. Martin's Press, New York, 1976.

Comments on the index by Ms. Wendy Osborne are gratefully acknowledged.

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## TECHNICAL WRITING STYLE GUIDE

### 1. INTRODUCTION

The basic requirements for staff and contractor documents are given in NRC Manual Chapters 3201, 3202, and 1102.\*

This style guide, Part III of MC 3201, provides recommended guidance for U.S. Nuclear Regulatory Commission staff and contractors in the preparation of draft and final documents. The objectives of this style guide are to:

- Improve document readability,
- Standardize document format,
- Ensure consistency of staff and contractor documents,
- Ensure completeness of documents,
- Facilitate information retrieval,
- Ensure complete source documentation.

Documents directed toward a technical audience should be written on a level understandable by an individual with a basic understanding of nuclear engineering principles. Documents directed toward a general audience should be written for the educated layman.

Include explanatory statements that provide background information on specialized subjects, unless lengthy, in the document. If longer than one or two pages, include such statements in an appendix.

In general, references cited in NRC documents must be available to the public. See Appendix A of this guide for proper indication of availability.

### 2. GENERAL FORMAT

Organize formal reports (including drafts)\*\* as follows using only those elements appropriate to the report:

<u>Element</u>	<u>Page Number</u>	<u>Right- or Left-Hand Page</u>
Title page	None	Right
Previous Documents in Series	None	Left
Abstract	iii	Right

\*Copies of these Manual Chapters can be obtained from the Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

\*\*See Glossary for definitions of Formal Staff and Contractor Reports.

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<u>Element</u>	<u>Page Number</u>	<u>Right- or Left-Hand Page</u>
Back of Abstract Page (blank)	None	Left
Contents	v	Right
List of Figures	Small Roman (odd or even)	Right or left
List of Tables	Small Roman (odd or even)	Right or left
Preface (or Foreword)	Small Roman (odd)	Right
Acknowledgments	Small Roman (odd)	Right
Nomenclature	Small Roman (odd)	Right
Executive Summary	First page unnumbered, but considered Arabic 1. Numbered consecutively thereafter in Arabic numerals.	Right
Introduction	Continue consecutive numbering with Arabic numerals.	Right
Text	Continue consecutive numbering with Arabic numerals.	Right
References	Continue consecutive numbering with Arabic numerals.	Right
Bibliography	Continue consecutive numbering with Arabic numerals.	Right or left
First and Subsequent Appendixes	Continue consecutive numbering with Arabic numerals.	Right for first; right or left for secondary
Glossary	Continue consecutive numbering with Arabic numerals.	Right
Index	Continue consecutive numbering with Arabic numerals.	Right

New chapters or major subdivisions may begin on a new left- or right-hand page. Assign odd numbers to right-hand pages and even numbers to left-hand pages.

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### 3. FRONT MATTER

#### 3.1 Cover (Formal Reports)

The cover, made of heavy, protective paper, should contain (1) the title of the document, (2) the author's name(s), (3) the type of document (for example, draft, final, task force), and (4) the NRC report number. (See MC 3201, 3202, and 1102 for additional information and sample covers.)

#### 3.2 Title Page (Formal and Interim Reports)

The title page should include (1) the title of the document, (2) the author's name(s), (3) the date of submission and publication, (4) document and contract numbers, (5) a status statement (if applicable), (6) the authorization (that is, the division ordering the work to be done), (7) the NRC division or office sponsoring the document, and (8) the NRC FIN number, if applicable. (See MC 3201, 3202, and 1102 for additional information and sample title pages for formal and interim reports.)

#### 3.3 Previous Documents in Series

If the document being prepared is one in an ongoing series, list all previous documents in the series. Include document numbers and issuance dates. Place this list on the back of the title page.

#### 3.4 Abstract

Prepare an abstract of 200 words or less for each formal document (draft and final) and place it on a separate page between the list of previous documents in the series and the contents pages. The abstract should address the major points of the document, including the investigations the document covers, and any findings, conclusions, and recommendations. The first sentence of the abstract should state the subject of the document.

Be concise; do not use words and ideas that are either repetitious or unnecessary. Take care, however, to include articles (a, an, the) and transitional words important to the document's readability (for example, moreover, nevertheless, however, but).

#### 3.5 Contents

In the contents, list the title and page number of each section of the document. Carry subheadings to at least the second degree of subordination. The subheadings serve essentially as an outline of the document. In the absence of an index, information retrieval is greatly enhanced by including the highest degree of subordination in the contents that appears in the text. (See contents of this document as an example.) Ensure that the page numbers and wording of chapter and section titles are identical with those in the text.

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### 3.6 List of Figures

Include a separate page listing figures if there are five or more figures in the document. The figure numbers and captions should correspond to those in the text. A list of figures is unnecessary for conference proceedings or symposium compilations.

### 3.7 List of Tables

Include a separate page listing tables if there are five or more tables in the document. The table numbers and titles should correspond to those in the text. Such a list is unnecessary for conference proceedings or symposium compilations.

### 3.8 Preface (or Foreword)

A preface is an optional introductory statement about a document written by the author. A foreword is an introductory statement written by someone other than the author. A preface highlights the relationship of the work to the NRC program. If a preface or foreword is not included, place this optional material in the introduction (see Section 4.3).

### 3.9 Acknowledgments

The document may include a section giving credit to any persons or groups who assisted in preparing the report. If the acknowledgment is not lengthy, it may be included as part of the preface; otherwise acknowledgments should appear separately, following the preface. If the document does not contain a preface, place the acknowledgment page immediately preceding the text.

### 3.10 Nomenclature

#### 3.10.1 Abbreviations and Symbols

When reference to a list of abbreviations and symbols would be useful to your audience, list the abbreviations and symbols in a separate section. Such a list is particularly helpful to the reader of a large document because, even if the abbreviation or symbol is explained the first time it appears in the text, it is easier for the reader to find it in a listing than to find the first place it appears in the text. See Appendix B for guidelines on the preparation of such lists.

The nomenclature list, labeled as such, should appear as the last section of the front matter, on a new right-hand page. Abbreviations and symbols commonly used in NRC documents appear in Appendix B. Less familiar words and terms may also be abbreviated in the text if the abbreviation is explained where it first occurs. When you are uncertain about how to abbreviate a word, write it out. Be aware that some abbreviations stand for more than one term; A, for example, represents both ampere and angstrom. If the context makes such overlapping abbreviations intelligible, use them; otherwise, spell out those terms that have identical abbreviations if they occur in the same report.

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Note these rules for abbreviations. Abbreviate units of measure, quantity, and time only when they are preceded by a numeral; use the percent symbol (%) only with numerals. An abbreviation is the same whether singular or plural (1 kg, 25 kg) unless it is in all-capital form such as RV, "reentry vehicle," which becomes "RVs." Abbreviate "accelerations of gravity" to "gs" to distinguish it from "g" for "grams."

Do not use double prefixes. Write ns, not m $\mu$ s, for nanosecond; GW, not kW, for gigawatt; and pF, not m $\mu$ F, for picofarad. Use  $\mu$ m for micrometer; micron ( $\mu$ ) should not be used.

When a prefix is placed before the symbol of a unit, the combination may be regarded as a single symbol that can be raised to a positive or negative power without using brackets; thus, mm<sup>3</sup>, and  $\mu$ s<sup>-1</sup>. Remember that mm<sup>3</sup> means (0.001 m)<sup>3</sup>, not 0.001 m<sup>3</sup>, and that  $\mu$ s<sup>-1</sup> means (10<sup>-6</sup>s)<sup>-1</sup>, not 10<sup>-6</sup>s<sup>-1</sup>.

Further guidance on the proper use of abbreviations and symbols is presented in the U.S. Government Printing Office Style Manual, Chapters 9 and 10.

### 3.10.2 Definitions of Variables

A separate list should be included in the nomenclature section to define by name and unit of measure all variables used in mathematical expressions in the document. This list is particularly helpful to the reader of a large document because, even if the variable was properly defined in the text when first used, it is easier for the reader to find in a listing of variables than to find the first place it is defined in the text.

### 3.10.3 Acronyms and Initialisms

List acronyms and initialisms in alphabetical order in the abbreviations and symbols list. An acronym is a pronounceable term formed from the initial letters or parts of a compound expression, such as rem (Roentgen equivalent man), and FORTRAN (formula translation). An initialism is an unpronounceable abbreviation formed from the initial letters of a compound expression, such as FFTF (Fast Flux Test Facility) or ac (alternating current). To be sure that readers will recognize the acronym or initialism, enclose it in parentheses after the expression to which it refers. Thereafter, use the acronym or initialism only. When it is first used in the document abstract, reidentify an acronym in its first appearance. Acronyms for computer programs and many acronyms not adopted into the language as words are written in full capitals. For a listing of acronyms and initialisms common to nuclear engineering, see NRC's "A Handbook of Acronyms and Initialisms" (NUREG-0544).

### 3.10.4 Chemical Elements

Spell out the names of elements used as modifiers, such as "beryllium spacers" and "copper coating." Do not capitalize the initial letter when spelling out the element name.

Use element symbols when giving an exact chemical formula (H<sub>2</sub>SO<sub>4</sub>) or alloy composition. Use "Uranium-238" at the beginning of a sentence; otherwise, use

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"<sup>238</sup>U." Do not place a period after a symbol unless it appears at the end of a sentence.

Indexes placed around the symbol indicate mass number (upper left), atomic number (lower left), state of ionization or nuclear excited state (upper right), and number of atoms (lower right). Usually the atomic number may be omitted; for example, <sup>12</sup><sub>6</sub>C may be written <sup>12</sup>C. Indicate the ionic charge by a superscript plus or minus sign following the symbol of the ion. For multiple charges, a superscript Arabic numeral precedes the plus or minus sign, for example, Co<sup>2+</sup>, Hg<sup>2+</sup>, Pu<sup>3+</sup>. Show a metastable state by the upper left index, for example, <sup>110m</sup>Ag. To show an electronic excited state, use an upper right asterisk, He\*.

#### 4. TEXT

##### 4.1 Title of Document

Since the title of your document is the first thing your reader sees, it should indicate the specific topic and suggest the document's scope and objective. Titles that are either too vague or unnecessarily long prevent efficient information retrieval by researchers and librarians, who often have only a title on which to decide whether or not to obtain a document.

Too Vague: "Approved Category A Task Action Plans"

Preferred: "Plans for Resolving Unresolved LWR Safety and Environmental Issues"

Too Wordy: "Office of Nuclear Reactor Regulation Technical Report on Operating Experience with BWR Pressure Relief Systems"

Preferred: "Operating Experience with BWR Pressure Relief Systems"

Announcing the NRC program office in the title is unnecessary because that information will appear elsewhere on the report cover.

If the report covers a specific period of time (quarterly, annual), identify this fact in a subtitle.

OCCUPATIONAL RADIATION EXPOSURE  
Annual Report for 1978

Do not use "Report on ..." or "Technical Report on ..." in the title, since that information will be self evident.

Avoid abbreviations in report titles, especially if the abbreviations come from fields outside of nuclear engineering.

Confusing: "LLEA Response Capabilities"

Preferred: "Local Law Enforcement Agency Response Capabilities"

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Center the title of the document at the top of the first page of the text, like an appendix or chapter title.

## 4.2 Executive Summary

Documents (other than short summary reports) should include a 500- to 1000-word executive summary of major findings, conclusions, and recommendations (if any) of the document. The summary states the purpose and nature of the investigation. It also provides a brief account of the procedures used and a concise overview for persons in management positions. Although more complete than an abstract, the summary should not contain a detailed description of the work upon which the findings, conclusions, and recommendations are based. The summary section immediately follows the title of the document on the first text page. (See Manual Chapter 1102.)

## 4.3 Introduction

### 4.3.1 Objective

The introduction should state the goals and objectives of the work done. This statement should answer two questions: What was the objective of the study, and why was the study done?

### 4.3.2 Scope and Limitations

The introduction should define the scope and limitations of the study, and specify boundary conditions explicitly. The reader should be able to ascertain quickly what the study does and does not investigate.

### 4.3.3 Organizational Paragraph

The introduction may include a paragraph that expresses the relationship of each chapter or appendix to the overall study objective.

## 4.4 Body

### 4.4.1 General Requirements

#### 4.4.1.1 Audience

Documents directed toward a technical audience should be written on a level understandable by an individual with a basic knowledge of nuclear engineering principles. Documents directed toward a general audience should be written for the educated layman.

Include explanatory statements that provide background information on specialized subjects, unless lengthy, in the document. If longer than one or two pages, include such statements in an appendix. (See Section 4.4.1.3, Length of Text.)

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#### 4.4.1.2 Transition

Use transition as a means of linking ideas in a document so that their relationship to one another is clear. Use of transitional words and phrases leads the reader smoothly from idea to idea throughout the text.

Certain words and expressions are inherently transitional:

hence, therefore, consequently, for example, specifically,  
furthermore, also, however, accordingly, in summary, to conclude

You can use these and similar expressions to achieve transition between sentences and paragraphs, as in this example (where transitional words and phrases are underlined):

XYZ, Inc., continued to provide support for the communication analysis effort during this quarter. In December, XYZ final reports entitled "Transportation Safeguards System and Network Analysis Model II" and "Evaluation of Transportation Safeguards" were received at the laboratory. These reports present the results of analysis for Task II, Task III, and Task IV of the five-task XYZ contract. A briefing on the Task III and Task IV results was given to laboratory representatives by the XYZ staff on 15 November. At that time, a decision was made to present these results to NRC at the beginning of the next quarter.

Communication analysis for next quarter, however, will focus on....

#### 4.4.1.3 Length of Text

The text should focus on the report's stated objective. Place ancillary or essential background information, such as lengthy tables and derivations, in an appendix, especially if the explanations are longer than two pages.

#### 4.4.1.4 Overall Consistency

When several different authors write sections of draft or final documents, assign one overall editor to integrate the material to achieve a document with a consistent writing style.

#### 4.4.2 Content

##### 4.4.2.1 Method

This section should describe the method chosen to carry out the study, the advantages of this method, and how the stated objectives are met.

##### 4.4.2.2 Assumptions

Include a complete list of the assumptions used and the justification for using them. Discuss any alternative assumptions that were evaluated but dismissed and give the reasons for their dismissal. Describe the effect of assumptions on the applicability of the study or the level of confidence of



the results. Describe nontrivial mathematical operations in detail and provide an explanation of the methodology used and why it was chosen.

#### 4.4.2.3 Results

State results objectively. Show how they follow from the study objectives and methodology. Point out unexpected results both in the results section and in the summary section of the report.

#### 4.4.2.4 Analysis and Conclusions

Describe the method used to interpret the results. The conclusions should state the significance of the results in relation to the stated problem. In presenting the conclusions, include a statement on the level of confidence in the conclusions. Make clear where the use of subjective judgment or expert opinion was used. Clearly identify speculative or unsubstantiated assertions.

#### 4.4.2.5 Recommendations

Indicate the course of action recommended based on the interpretation of the study results. Include in the recommendations, if appropriate, suggested methods for obtaining additional information and a justification for obtaining such information.

#### 4.4.3 Chapters

Include a title and an introductory paragraph for each chapter (or major section). Indicate in the introductory paragraph what material is covered in the chapter and the relationship of the material covered in the chapter to the overall document.

Place references at the end of the whole report in a separate section or at the end of sections or chapters if the document is lengthy.

#### 4.4.4 In-Text Referencing

Should more than one section of the same document require in-text referencing, give the proper reference notation in the text at the point where the reference is made (see Appendix A). Use references both to give proper credit for previous work and to guide the reader to sources. When directing readers to information in appendixes or other sections of the document, place such direction in parentheses, such as (see Appendix A). The reference should be as specific as possible and include page number(s) if necessary.

#### 4.4.5 Incorporating Quoted Material in the Text

Material quoted word for word from another document can be incorporated into the text in one of two ways. To highlight quoted information because of its significance, set it off from the text by indenting five spaces from the left margin and five spaces from the right margins and by double spacing above and below the passage. Inset quoted passages are single spaced and are not enclosed in quotation marks. Quoted passages that do not require highlighting are "run in" to the text and are enclosed in quotation marks.

Lacking other guidance, use the following rule of thumb for when to and when not to indent. Incorporate quotations of five lines or fewer into the text, enclosing them in quotation marks. Set off quotations longer than five lines; do not enclose them in quotation marks.

#### 4.5 Pagination

Paginate all documents as indicated in Section 2, General Format, of this style guide.

#### 4.6 Identification of Equations and Artwork

Uniquely identify all artwork and important or referenced equations.

##### 4.6.1 Equations

Number displayed equations sequentially by chapter, such as (1-1), (1-2), . . . , (2-1), (2-2), . . . , at the right margin aligned with the equation or the last line of the equation and refer to them in the text as Eq. 1-1, Eq. 1-2, etc. . . . Number equations in appendixes (A-1), (A-2), . . . at the right margin and refer to them in the text as Eq. A-1, Eq. A-2. . . . Appendix C of this style guide contains additional information on displaying mathematical equations.

If there are no numbered chapters, equations may be numbered sequentially (1, 2, 3, . . .) and referred to in text as Eq. 1, Eq. 2, . . .

##### 4.6.2 Artwork

Section 6 and Appendix D of this style guide contain information on the identification of artwork (figures, photographs, etc.) and on the preparation of such material.

#### 4.7 Footnotes

Use footnotes in the body of the document only for explanatory material. If the material is extensive, place it in a separate appendix rather than in a footnote. Cite literature used in the preparation of a document and referred to in the text in the reference section. (See Appendix A for reference guidelines.)

Place footnotes at the bottom of the text page between the last line of text and the page number; that is, the last line of the footnote should be on the bottom line of the image area. (Based on an 8½- x 11-inch page size, the allowable image area would be 6½ x 9 inches.) Double space between the last line of text and the first line of the footnote. A 1½-inch or 20-space line should appear above the first footnote on each page.

Use single, double, or triple asterisks or daggers to mark footnotes in the text and at the bottom of the page.

Use footnotes in tables and graphs for explanations of individual items in the table. Use symbols (\*, †) or lower-case letters, rather than numbers, to key

footnotes where numbers could be mistaken for tabulated information. Orient footnote symbols from left to right and from top to bottom.

#### 4.8 Computer Material

Technical documents include two general categories of computer material: computer program descriptions and computer output. Computer program descriptions explain either how a program is developed or how a program is used in an analysis. Computer output presents the results of an analysis.

##### 4.8.1 Computer Program Description

###### 4.8.1.1 Explanation of Program Development

Present the explanation of program development in the text of a document. Clearly identify the approach, assumptions, scope, and limitations of the program. The approach includes topics such as numerical solution techniques, basic theory, mathematics, and approximations (for example, curve fitting). Give a clear explanation of why a particular approach was used. Present long derivations in appendixes.

###### 4.8.1.2 Explanation of Program Use

Include the following information when using an already-existing program to provide input to a document:

- (1) An explanation of how and why the program was used (in text).
- (2) The scope and limitations of the program (in text).
- (3) A program summary (in one appendix for all the program summaries).
- (4) Documentation (either as an appendix or as a reference to an available document).

##### 4.8.2 Computer Output

When computer output is used in a document, clearly label the output and provide a high-quality copy (that is, a reproducible copy). Include with the copy an explanation of the program used to generate the output (see Section 4.8.1.2) and an explanation or listing of the inputs used to generate the output.

#### 4.9 Report Mechanics

Appendix E of this style guide contains information on the following:

- (1) Chapter (or section) dividers
- (2) Paper
- (3) Appearance
- (4) Pagination
- (5) Spelling
- (6) Preferred usage

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## 5. BACK MATTER

### 5.1 References

Cite references that are accurate and pertinent to the subject. Do not list references with which you are not personally familiar. Ensure that all references used in a document are properly credited, and that the references are complete enough to allow a reader to locate the sources. (See Appendix A for specific guidelines.)

Do not cite explanatory material as a reference. Present such materials in a footnote or appendix or incorporate them into the text.

Consult Chemical Abstracts Service Source Index (CASSI) or the Bibliographic Guide for Editors and Authors for abbreviations and spelling of journal names. (See Section 8, Bibliography, for full references to these works.)

#### 5.1.1 Format

Number citations of source documents consecutively in the order in which they appear in the text. Identify references by Arabic numerals in parentheses, such as (Ref. 1). Cite references in tables or figures completely. Do not cite references in titles or abstracts, however. Type multiple-line citations single spaced, and double space between citations. Type the second and subsequent lines of an entry flush with the same margin as the first line, so that the reference number stands out. (See Appendix A for guidelines on how to cite specific references.)

To re-cite a reference in the text, simply repeat its text reference number. Appendixes that cite references should have their own reference lists. Spell out "reference" when you identify a specific source in a text sentence: "The data in Reference 3 include ..." Abbreviate "reference" when it appears in text parenthetically (Ref. 3).

#### 5.1.2 Availability Requirement

The provisions of 10 CFR § 2.740 and 10 CFR § 9.4 require that source material in NRC regulatory and technical documents be readily available to the public in the NRC Public Document Room (PDR) or available from a public library. Accordingly, present references in a format recognizable by a librarian. References to information not available in the open literature should state where the document can be purchased or copied. Do not use sources that are not publicly available, such as "unpublished data," "personal communications," or "internal documents." If such a source is pertinent and necessary, include information from it in a brief paragraph in the text, in a footnote, or in an appendix. (See Appendix A for guidelines.)

#### 5.1.3 Proprietary and Classified Documents

When using nonproprietary or unclassified (or declassifiable) information contained in proprietary or classified documents as source material, insert the information in the body of the text or in a footnote to the text, copy and

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place the information in an appendix, or abstract and make the information available for inspection and copying for a fee at the NRC Public Document Room and then cite it as a reference to the text.

Citing classified or proprietary documents is strongly discouraged; in some instances, however, reference to classified or proprietary documents cannot be avoided because they are the only source for certain information. Even though the documents must be withheld from the public, make the public aware that such documents served as the bases for the information. Accordingly, reference proprietary and classified documents when necessary. (Omit the title if the title is classified.) This type of reference should include a statement such as the following: "This document is not publicly available because it contains proprietary or national security information."

#### 5.1.4 Copyrighted Material in NRC Publications

To quote from copyrighted material in an NRC publication to be made available to the public, you must obtain permission from the copyright holder. (The copyright holder is usually the publisher of the book or journal.) Permission is usually granted if the usage will not harm the author or prejudice sale of the copyrighted material. If permission is not granted, or if you cannot determine who holds the copyright, contact the Patent Counsel of the Office of the Executive Legal Director.

To obtain permission, send the copyright holder either a copyright release form or a brief note. (Copyright release forms are available from the Policy and Publications Management Branch of the Division of Technical Information and Document Control.) If the copyright release must be obtained quickly, secure permission over the telephone. Upon approval, confirm the release by sending the holder a copyright release form that should be signed and sent back to the NRC office making the request.

When permission to reproduce the work has been obtained, cite the copyright holder in a source or credit line where the information is referenced. If the holder does not request a particular credit line, use the following:

Permission to use this copyrighted material was granted by [name of copyright holder].

#### 5.2 Bibliography

List citations of other documents pertinent to the subject but not referenced in the text in a bibliography. Arrange bibliographic entries alphabetically by personal or corporate author name. In general, most NRC documents need not have bibliographic sections unless the study required a literature search.

The bibliography, labeled as such, should follow the last reference section in the text and begin on a new page, either right or left. (See Appendix F for a sample bibliography.)

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### 5.3 Appendixes

The appendixes should comprise information that is supplemental to the report. The types of material to be placed in the appendixes are (1) explanations too long for footnotes but helpful to the reader seeking further assistance or clarification, (2) passages from documents or laws that support or illustrate the text, or (3) long charts, tables, or computer printouts.

Place the first appendix on the first right-hand page directly after the reference section or bibliography. Begin each additional appendix on a new page, either right or left. Identify each appendix by an appendix heading and title (for example, Appendix B, Nomenclature in a Report). When there is more than one appendix in a document, sequence them in the order in which they are referred to in the text. A reference to Appendix B, for example, should not precede the first text reference to Appendix A.

The contents of each appendix should be identifiable without referring back to the body of the document. An introductory paragraph describing the appendix contents is therefore necessary for many appendixes, including those containing computer printouts, data tables, or similar information. Outline lengthy appendixes or those containing information on several topics in the table of contents (see front matter of this document). If several symbols or abbreviations are used in the appendix (as in a mathematical derivation), identify them in a nomenclature section following the introduction of the appendix. When only a few symbols or abbreviations are used, identify them where they are used in the body of the appendix. Compile and list materials cited in an appendix at the end of the appendix in a separate reference section.

### 5.4 Glossary

Include a glossary if the document contains many terms that might be unfamiliar to the intended audience. Arrange terms alphabetically, with each new entry beginning on a new line. Definitions should follow the term on the same line, dictionary style. Place the glossary, labeled as such, directly after the appendix, beginning on a new right-hand page, or before the nomenclature or the introduction section, beginning a new page.

### 5.5 Index

A report index lists, in alphabetical order, all pertinent topics discussed in a report and cites the page number(s) where the topic can be found within the report text. The index, labeled as such, should appear as the last section of a report and begin on a right-hand page.

The main purpose of an index is to make a report more useful by allowing the reader to look up a topic or topics alphabetically. The key to creating a useful index is to choose those terms that best represent the report's pertinent topics.

To create an index, select the pertinent terms from the final version of the document manuscript. Enter each term on a 3x5-inch index card and arrange the cards in alphabetical order. Each time a term appears in the text, enter

its page number on the index card. When you have completed this process, have the index section typed from this set of cards.

Index entries are divided into headings that concisely specify a particular subject discussed within the text and their page references. A complete entry consists of the principal entry, subentries and cross-references, if any, as indicated in the following example:

Monitoring programs, 27-49	<u>Heading</u>
aquatic, 42	
ecological, 40	
meteorological, 37	<u>Subheadings</u>
radiological, 30	
terrestrial, 41, 43-44	
thermal, 27	
staff evaluation and recommendations, 45-49	<u>Sub-subheading</u>

Each subentry in the index appears on a separate line, indented from the main entry to which it refers. Sometimes a sub-subentry is needed and is indented from the preceding subentry.

Cross-references are devices inserted at appropriate places in the index to guide the reader to the complete information in the text. They consist of two general kinds - "see" references and "see also" references. "See" references are used when the indexer has chosen among several key words:

Economic costs. See benefit-cost analysis.

when the subject has been treated as a subentry to a principal entry:

Radiological impacts. See environmental effects of station operation, radiological impacts.

or when reference is from a popular or shortened form of a term to the "official," scientific or full form:

China syndrome. See reactor core meltdown.

"See also" references are used when additional information can be found in another entry or subentry.

Ecological programs, 40-49. See also monitoring programs.

The index in this style guide is an example of the indented style, where each subentry begins a new line and is indented from the left. The indented style is recommended for detailed subjects because the indentions allow the reader to scan a column quickly for pertinent subentries.

## 6. TABLES AND ILLUSTRATIONS

The primary purpose of including tables and illustrations in your writing is to increase your reader's understanding of what you are saying in ways that words alone cannot. Pictures show shapes and relationships in space far

better than even the most skillful description. Graphs show trends and mathematical relationships in ways that are immediately grasped. Tables allow easy comparisons between large numbers of statistics that would be difficult to understand written in sentence form. Many of the qualities of good writing - simplicity, clarity, conciseness, directness - are equally important in creating and using illustrations and tables.

Copyrighted graphics information cannot be reproduced in NRC publications without written permission from the copyright holder. To secure permission from the copyright holder, obtain a copyright release form from the Policy and Publications Management Branch of the Division of Technical Information and Document Control.

When permission to reproduce the work has been granted, cite the person or organization that holds the copyright in a source or courtesy note. (See Table D.1, Appendix D for an example of a source line.)

### 6.1 Tips for Creating Tables and Illustrations

The following general guidelines apply to most visual materials. Detailed guidelines for specific types of illustrations are given with the discussion of each type:

- (1) Keep the information as brief and simple as possible.
- (2) Try to present only one type of information in each illustration.
- (3) Label or caption each illustration clearly.
- (4) When necessary, include a key that identifies all symbols.
- (5) When appropriate, specify the proportions used, or include a scale of relative distances.
- (6) Keep terminology consistent. Do not refer to something as a "proportion" in the text and as a "percentage" in the illustration.
- (7) Allow enough white space around and within the illustration for easy viewing.
- (8) Position the illustration as close as possible to the text that refers to it; however, an illustration should never appear ahead of the first text reference to it.
- (9) Be certain that the significance of each illustration is clear from the text.
- (10) If several illustrations or tables are used, number the illustrations or tables consecutively.
- (11) If more than five illustrations or tables appear in a formal report, list them, together with figure and page numbers, under a separate heading

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following the table of contents, labeled "List of Figures" or "List of Tables."

If presented with clarity and consistency, illustrations can help the reader focus on key portions of the report. Even the best illustration only supplements the text, however. The writing must provide the context for the illustration and point out its significance. Appendix D provides detailed guidance on the creation of tables and illustrations.

## 6.2 Availability of Existing Graphics Works at NRC

Standardized graphics works on many technical and regulatory topics already exist in camera-ready form for use in publications and in the preparation of Vu Graphs. Check with your branch chief, with the Special Projects Branch (OMPA), or with the Printing and Graphics Branch for the availability of pertinent maps, tables, graphs, photographs, organizational charts, and the like.

## 7. MATHEMATICS

### 7.1 Writing Numbers

Authors must often decide whether to use numerals or to spell out a number. Appendix C provides rules based on the principle that readers comprehend numerals more readily than spelled-out numbers. Some rules, however, are based on typographic appearance.

### 7.2 Typing Mathematical Material

Type all mathematical material. For more specific information dealing with equations, refer to Appendix C (Section 4, Displayed Equations).

## 8. BIBLIOGRAPHY

Brusaw, C. T., G. J. Alred, and W. E. Oliu. Handbook of Technical Writing. New York: St. Martin's Press Inc., 1976. Available from St. Martin's Press, Inc., 175 Fifth Avenue, New York, NY 10010.

Chemical Abstracts Service. Bibliographic Guide for Editors and Authors, Biosciences Information Service of Biological Abstracts. American Chemical Society, 1974. Available from public and technical libraries.

Chemical Abstracts Service. Chemical Abstracts Service Source Index (CASSI), 1907-1974 Cumulative, 2 vols. American Chemical Society, 1974. Available from public and technical libraries.

U.S. Government Printing Office. Style Manual. Washington, DC: U.S. Government Printing Office, January 1973. Available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

U.S. Nuclear Regulatory Commission. "A Handbook of Acronyms and Initialisms." USNRC Report NUREG-0544, March 1979. Available for purchase from the National Technical Information Service, Springfield, VA 22161.

U.S. Nuclear Regulatory Commission. "Manual Chapter 3201, Publication of Unclassified NRC Staff-Generated Regulatory and Technical Documents." Washington, DC: U.S. Nuclear Regulatory Commission, June 27, 1977. Available from NRC Division of Technical Information and Document Control, Document Management Branch.

U.S. Nuclear Regulatory Commission. "Manual Chapter 3202, Publication of Unclassified Regulatory and Technical Documents Prepared by NRC Contractors, Including Reports Prepared Under or Pursuant to Interagency Agreements." Washington, DC: U.S. Nuclear Regulatory Commission, January 25, 1978. Available from NRC Division of Technical Information and Document Control, Document Management Branch.

U.S. Nuclear Regulatory Commission. "Manual Chapter 1102, Procedure for Placement of Work with the Department of Energy." Washington, DC: U.S. Nuclear Regulatory Commission, to be issued. Available from NRC Division of Technical Information and Document Control, Document Management Branch.

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## APPENDIX A

### EXAMPLES OF REFERENCE CITATIONS

#### 1. INTRODUCTION

This appendix provides guidelines for the preparation of reference citations. For references requiring the same availability statement, place the statement(s) at the bottom of the page in a footnote rather than repeating the statement in each pertinent reference.

#### 2. EXAMPLES OF REFERENCE CITATIONS

##### 2.1 Correspondence

References to letters or memoranda should clearly indicate originator and the recipient.

Letter from D. B. Blackman, Georgetown Municipal Utility, to R. A. Gilbert, NRC, Subject: Answers to NRC Questions on Docket 50-825, dated January 31, 1975. Available in NRC PDR for inspection and copying for a fee.

Memorandum from D. F. Ross and D. G. Eisenhut, NRC, to D. B. Vassallo and K. R. Goller, "Interim Safety Evaluation Report on the Effects of Fuel Rod Bowing on Thermal Margin Calculations for Light Water Reactors," December 8, 1976. Available in NRC PDR for inspection and copying for a fee.

##### 2.2 Internal Papers

Do not reference internal papers, such as technical notes and minutes of meetings, unless they are already available in the NRC Public Document Room (PDR) or will be made available in the PDR before issuance of the report. For a technical note, list author (if any), title, and date, and state that it is "available in the NRC PDR for inspection and copying for a fee." The same format is applicable to minutes of meetings. Do not reference calculations and working papers. If the information in them is pertinent to the text of the report, make it part of the report as text, footnote, or appendix.

##### 2.3 Personal Communications, Private Communications, Notes on Visits

Do not cite references of the following type.

J. G. Facer, ERDA Grand Junction Office, personal communication to M. B. Sears, Oak Ridge National Laboratory, December 16, 1975.

Staff visit to the Exxon mine waste dump, Converse County, Wyoming, April 12, 1972.

In both instances, place these remarks directly in the text (or as a footnote) because they do not represent any retrievable information.

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## 2.4 Procedures Manuals

Do not reference procedures manuals unless the manuals are available for inspection and copying by the public. Give sufficient information in the citation to indicate where they can be obtained. If specific procedures are pertinent, repeat them in the text without reference to specific documents.

## 2.5 Federal Agency Documents and Drafts that Have Been Made Available to the Public for Comment

When referencing specific pages, insert volume and page numbers following the title; for example, Vol. 4, pp. 10-20, 500-730.

For draft reports:

U.S. Nuclear Regulatory Commission. "Review and Assessment of Package Requirements (Yellowcake) and Emergency Response to Transportation Accidents," USNRC Draft Report NUREG-0535, March 1979. Single copies are available from USNRC Division of Technical Information and Document Control, Washington, DC 20555.

For final reports:

U.S. Nuclear Regulatory Commission, "Reactor Safety Study - An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," Executive Summary, WASH-1400 (NUREG-75/014), October 1975. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.

U.S. Nuclear Regulatory Commission, "Final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors," USNRC Report NUREG-0002, Vols. 1-5, August 1976. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.

R. O. Meyer, "The Analysis of Fuel Densification," p. 48, USNRC Report NUREG-0085, July 1976. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.

For NRC Safety Standard Review Plan:

U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants - LWR Edition," USNRC Report NUREG-75/087, Section 2.3.1, "Regional Climatology," Rev. 1. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.

References to Regulatory Guides should carry neither the date of issuance nor the revision number. The basic format for draft Regulatory Guides is as follows:

U.S. Nuclear Regulatory Commission. Draft Regulatory Guide, Task OH 717-4. "Radiation Protection Training for Light-Water-Cooled Nuclear Power Plant Personnel." Single copies are available from the USNRC Division of Technical Information and Document Control, Washington, D.C. 20555.



The basic format for active Regulatory Guides is follows:

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.31, "Control of Ferrite Content in Stainless Steel Weld metal". Copies are available from U.S. Government Printing Office, Washington, D.C. 20402. ATTN: Regulatory Guide Account.

## 2.6 NRC Contractor Reports and Reports Prepared on Interagency Agreements

For formal reports:

R. J. Brouns, F. P. Roberts, and U. L. Upson, Battelle Pacific Northwest Laboratories, "Considerations for Sampling Nuclear Materials for SNM Accounting Measurements," USNRC Report NUREG/CR-0087, May 1978. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.

For interim reports:

G. L. Bordner and others, "Pretest Analysis SLSF In-Reactor Experiment 62," USNRC Accession No. 771090001, prepared for NRC by Argonne National Laboratory, October 1976. Available in NRC PDR for inspection and copying for a fee.

## 2.7 NRC Applicant Documents

Exxon Nuclear Corporation, "Preliminary Safety Analysis Report, Nuclear Fuel Recovery and Recycling Center," Vol. 3, p. 5.4-3, Docket 50-564, June 1976. Available in NRC PDR for inspection and copying for a fee.

## 2.8 Project Documents

For project documents, use the format given in Section 2.7 and replace the docket number with the project number.

## 2.9 Licensee Documents

For licensee documents, use the format given in Section 2.7 for applicant documents and use the docket number or the license number.

## 2.10 Congressional Hearings, Reports, Acts, and Testimony

To cite legal references, follow examples set forth in A Uniform System of Citation, Harvard Law Review Association, Cambridge, Massachusetts, 1976, 12th edition. (Reference copies are available from the NRC Law Library.)

## 2.11 Federal Register Notices

U.S. Nuclear Regulatory Commission, "Licensing Procedures for Geologic Repositories for High-Level Radioactive Wastes," Federal Register, Vol. 43, No. 223, Nov. 17, 1978, 53869-53872.

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## 2.12 Books

S. Glasstone, Sourcebook on Atomic Energy, p. 155, D. Van Nostrand Co., Inc. New York, 1974.

When a book consolidates various articles as chapters in the book, use the following reference format.

K. A. Gschneidner, Jr., and J. T. Waber, "Principles of the Alloying Behavior of Rare-Earth Metals," in The Rare Earths, F. H. Spedding and A. H. Daane, Eds. (John Wiley and Sons, Inc., New York, 1961), Chap. 17, pp. 386-427.

## 2.13 Conference Papers

Do not reference unpublished conference papers. Incorporate the information being used in the text and give credit to the originator in the text or in a footnote. If the originator can supply a paper, place it in an appendix and mention it in the text. (For further information on conference documentation, refer to Manual Chapter 3207, Conferences and Conference Proceedings, Ref. 2.)

Reference published conference papers as follows:

E. B. Norris and J. S. Perrin, "Determination and Evaluation of the Mechanical Properties of Specimens in Commercial LWR Pressure Vessel Surveillance Programs," Vols. 3, p. 1113 in Proceedings of the Second ASTM-EURATOM Symposium on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, USNRC Conference Proceeding NUREG/CP-0004, Vol. 3, Oct. 1977. Available for purchase from the National Technical Information Service, Springfield, VA 22161.

## 2.14 Journal, Magazine, and Newspaper Articles

S. D. Shearer and C. W. Still, "Evaluation of Atmospheric Radon in the Vicinity of Uranium Mill Tailings," Health Physics 17, 77-88 (1976). Available in public technical libraries.

"Why the Nuclear Power Race Worries the U.S.," p. 68, Business Week, August 23, 1976. Available in public libraries.

"Argentina Says It Has Atom Fuel to Triple Its Electrical Capability," p. 53, The New York Times, August 31, 1976. Available in public libraries.

## 2.15 University Theses

J. J. Jacobs, "Programming Language 1 for the Varian PLCU," Master's Thesis, p. 70, North Carolina University, 1971.

## 2.16 Foreign Reports

P. M. S. Jones, "The Physical Stability of Metal Tritides, Lithium Tritide, and Deuterotritides," Atomic Weapons Research Establishment report AWRE-0-27/67, Aldermaston, England (June 1967).

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## 2.17 Encyclopedia Articles

S. P. Johnston, "Airplane," Encyclopaedia Britannica (1968).

(Because the articles are arranged alphabetically, volume and page numbers are unnecessary. If the entry does not list an author, begin the reference with the article title.)

## 2.18 Translations

V. L. Bouch-Bruevich, Electronic Theory of Heavily Doped Semiconductors (American Elsevier, 1966, translation), 131 pp.

## 2.19 Codes and Standards

"American National Standard Requirements for Collection, Storage and Maintenance of Quality Assurance Records for Nuclear Power Plants," ANSI N45.2.9-1974. Available from American National Standards Institute, 1430 Broadway, New York, NY 10018, Copyrighted.

"American National Standard Guidelines on the Nuclear Analysis and Design of Concrete Radiation Shielding for Nuclear Power Plants," ANSI/ANS-6.4-1977. Available from American National Standards Institute, 1430 Broadway, New York, NY 10018, Copyrighted.

## 2.20 Patents

W. J. Entdecker, "Autoheuristic Hypothesizer," US Patent No. 4 321 098, November 1970.

## 3. BIBLIOGRAPHY

U.S. Nuclear Regulatory Commission. "Manual Chapter, 3202, Publication of Unclassified Regulatory and Technical Documents Prepared by NRC Contractors, Including Reports Prepared Under or Pursuant to Interagency Agreements." Washington, DC: U.S. Nuclear Regulatory Commission, January 25, 1978. Available from NRC Division of Technical Information and Document Control, Document Management Branch.

U.S. Nuclear Regulatory Commission. "Manual Chapter 3207, Conferences and Conference Proceedings." Washington DC: U.S. Nuclear Regulatory Commission, September 12, 1978. Available from NRC Division of Technical Information and Document Control, Document Management Branch.

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## APPENDIX B

### NOMENCLATURE IN A REPORT

#### 1. INTRODUCTION

This appendix provides lists of symbols, abbreviations, and acronyms commonly used in NRC reports. If your document requires the use of uncommon terms, compile this type of information in a nomenclature list. Include in the list only those abbreviations, symbols, or acronyms actually used in the report, arranged alphabetically.

#### 2. ABBREVIATIONS, SYMBOLS, AND ACRONYMS

Use the abbreviation for a unit of measure only when it is preceded by a numeral. Do not start a sentence with an abbreviation. Use periods following abbreviations only as shown in this section or when the abbreviation forms a word. "A Handbook of Acronyms and Initialisms" (NUREG-0544), listing the information commonly used in NRC reports, is available from NRC's Division of Technical Information and Document Control.

absolute.....	abs
acceleration of gravity.....	g (plural, gs)
alpha (prompt multiplication rate).....	$\alpha$ (gen/ $\mu$ s)
alternating current.....	ac
altitude.....	alt
amagat.....	spell out
ampere.....	A
ampere per meter.....	A/m
ampere-turn per meter.....	At/m
amplitude modulation.....	AM
angstrom.....	Å
antilogarithm.....	antilog
antilogarithm, natural.....	antiln
appendix (appendixes).....	App. (Apps.)
approximate, approximately.....	approx
approximately equal to.....	$\approx$
atmosphere (unit).....	atm
atomic demolition munition.....	ADM
atomic mass units.....	amu
atomic number.....	Z, at. No.
atomic units.....	a.u.
atomic weight.....	a, at. wt
audiofrequency (adj.).....	af
average.....	av
bar.....	spell out
barn.....	b
basic assembly.....	BA
becquerel.....	Bq
billion electron volts.....	GeV, BeV
biot.....	Bi
body-centered cubic.....	bcc
Bohr.....	spell out

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Bohr magneton.....	μB
boiling point.....	bp
Brinell hardness number.....	Bhn
British thermal unit.....	Btu
calculated.....	calc
calorie.....	cal
candela.....	cd
candela per square meter.....	cd/m <sup>2</sup>
capacitance.....	C
cathode-ray tube.....	CRT
Celsius.....	C
center of gravity.....	c.g.
centigram.....	cg
center of mass.....	c.m.
centimeter.....	cm
centimeter-gram-second (unit system).....	cgs
centimeter per second.....	cm/s
centipoise.....	cP
chapter.....	Chap.
chemically pure.....	cp
coefficient.....	coeff
cologarithm.....	colog
complex conjugate.....	c.c.
concentrated, concentration.....	conc
constant.....	const
contact potential difference.....	cpd
continued.....	cont.
continuous wave.....	cw
coulomb (A·s).....	C
counts per minute.....	counts/min
counts per second.....	counts/s
cubic.....	cu
cubic centimeter.....	cm <sup>3</sup> (not cc)
cubic meter.....	m <sup>3</sup>
cubic millimeter.....	mm <sup>3</sup>
curie.....	Ci
cycle.....	spell out
cycles per second.....	Hz
day.....	spell out
debye.....	D
decibel.....	dB
degree.....	°, deg
degree Celsius.....	°C
density.....	ρ, d
Department of Energy.....	DOE
derivative.....	deriv
diameter.....	diam
difference, is similar to,.....	~
direct current.....	dc
disintegration per second.....	dis/s
drawing number.....	Dwg No.
dyne.....	dyn
east.....	E

edition(s), editor(s).....Ed. (Eds.)  
 efficiency.....eff  
 electromagnetic pulse.....EMP  
 electromagnetic units.....emu  
 electromotive force.....emf  
 electron.....e  
 electron paramagnetic resonance.....EPR  
 electron spin resonance.....ESR  
 electron units.....e.u.  
 electron volt.....eV  
 electrostatic units.....esu  
 entropy unit.....eu  
 equation(s).....Eq. (Eqs.)  
 equivalent.....equiv  
 erg.....spell out  
 erg second.....erg·s  
 error function.....erf  
 error function complement.....erfc  
 experiment(al).....expt(l)  
 exponent, exponential.....exp  
 face-centered cubic.....fcc  
 Fahrenheit.....F  
 farad (A·s/V).....F  
 femtometer.....fm  
 fermi ( $10^{-15}$  meters).....F  
 figure(s).....Fig. (Figs.)  
 fissions per second.....fis/s  
 freezing point.....fp  
 frequency.....freq  
   high.....hf  
   low.....lf  
   medium.....mf  
   superhigh.....shf  
   ultrahigh.....uhf  
   very high.....vhf  
   very low.....vlf  
 frequency modulation.....FM  
 full width at half maximum.....FWHM  
 function, hyperbolic  
   cosecant.....csch  
   cosine.....cosh  
   cotangent.....cot $\mathcal{h}$   
   secant.....sech  
   sine.....sinh  
   tangent.....tanh  
 function, trigonometric  
   cosecant.....csc  
   cosine.....cos  
   cotangent.....cot  
   coversine.....covers  
   exsecant.....exsec  
   haversine.....hav  
   secant.....sec

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sine.....	sin
tangent.....	tan
versine.....	vers
gauss.....	G
Geiger-Mueller (or Müller).....	G-M
generations per microsecond.....	gen/ $\mu$ s
gigaelectron volts.....	GeV, BeV
<sup>50</sup> GHz,ahertz.....	GHz
gigawatt.....	GW
gram.....	g
gram-atom.....	g $\cdot$ at.
gram-calorie.....	g $\cdot$ cal
gram-molecular volume.....	gmv
grams per cubic centimeter.....	g/cm <sup>3</sup>
grams per liter.....	g/liter
gray (J/kg).....	Gy
henry (V $\cdot$ s/A).....	H
hertz (cycle/s).....	Hz
hexagonal close-packed.....	hcp
high voltage.....	hv
hour.....	h
hyperfine structure.....	hfs
inductance-capacitance.....	LC
inductance, mutual.....	M
inductance, self.....	L
infrared.....	ir
inside diameter.....	i.d.
International Critical Tables.....	ICT
International System of Units.....	SI
joule (N $\cdot$ m).....	J
joule per Kelvin.....	J/K
joule per kilogram Kelvin.....	J/(kg $\cdot$ K)
Kelvin (never use $^{\circ}$ with K).....	K
kilobar.....	kbar
kilocalorie.....	kcal
kilocalories per mole.....	kcal/mol
kilocurie.....	kCi
kilocycles per second.....	kHz
kiloelectron volt.....	keV
kilogauss.....	kG
kilogram.....	kg
kilogram-force.....	kgf
kilogram-meter.....	kg $\cdot$ m
kilogram per cubic meter.....	kg/m <sup>3</sup>
kilohertz.....	kHz
kilohm.....	k $\Omega$
kilojoule.....	kJ
kilometer.....	km
kilometers per second.....	km/s
kilo-oersted.....	kOe
kilovolt.....	kV
kilovolt-ampere.....	kVA
kilowatt.....	kW

kilowatt-hour.....	kWh
kilowatt of electrical energy.....	kWe
kilowatt of thermal energy.....	kWt
kinetic energy.....	KE
knot, knots.....	spell out
laboratory (system).....	lab
lambert.....	L
latitude.....	lat
lethal dose (superscript denotes percent).....	LD <sup>30</sup>
limit.....	lim
liter, liters.....	L, or spell out
liter per second.....	L/s
local thermodynamic equilibrium.....	LTE
logarithm.....	log
logarithm, natural.....	ln
lumen (cd·sr).....	lm
lumens per watt.....	lm/W
lux (lm/m <sup>2</sup> ).....	lx
magnetomotive force.....	mmf
maximum.....	max
maximum permissible concentration.....	MPC
maxwell.....	Mx
mean free path.....	mfp
measured.....	meas
megabar.....	Mbar
megacurie.....	MCi
megahertz.....	MHz
megavolt.....	MV
megavolt-ampere.....	MVA
megawatt.....	MW
megawatt-hour.....	MWh
megohm.....	MΩ
melting point.....	mp
meter.....	m
meter-kilogram-second (unit system).....	mks
meter per second.....	m/s
meter per second squared.....	m/s <sup>2</sup>
mho.....	spell out
microampere.....	μA
microcoulomb.....	μC
microcurie.....	μCi
microequivalent.....	μeq
microfarad.....	μF
microgram.....	μg
microhenry.....	μH
microliter.....	μL
micrometer.....	μm
micromho.....	μmho
micromole.....	μmol
microsecond.....	μs
microvolt.....	μV
microwatt.....	μW
mil (for electrical wire).....	spell out



milliampere.....	mA
millibar.....	mbar
millibarn.....	mb
millicurie.....	mCi
milliequivalent.....	meq
millifarad.....	mF
milligram.....	mg
millihenry.....	mH
millilambert.....	mL
milliliter.....	mL
millimass units.....	mmu
millimeter.....	mm
millimeter of mercury.....	mm Hg
millimho.....	mmho
millimole.....	mmol
million electron volts.....	MeV
million gallons (geological use only).....	Mgal
million volts.....	MV
million years (geological use only).....	Myr
milliradian.....	mrad
millirem.....	mrem
millisecond.....	ms
millivolts.....	mV
milliwatt.....	mW
minimum.....	min
minute.....	min
mole.....	mol, or spell out
mole percent.....	spell out
molecular weight.....	mol wt
month.....	spell out
motor generator.....	m. g.
nanometer.....	nm
nanosecond.....	ns
nautical mile.....	spell out
neutron.....	n
neutrons per square centimeter.....	n/cm <sup>2</sup>
Nevada Test Site.....	NTS
newton (kg·m/s <sup>2</sup> ).....	N
normal (concentration).....	N
north.....	N
northern conjugate.....	NC
nuclear magnetic resonance.....	NMR
nuclear magneton.....	μN
nucleon.....	N
number(s).....	No. (Nos.)
observed.....	obs
oersted.....	Oe
ohm (V/A).....	Ω
optical density.....	OD
outside diameter.....	o. d.
oxygen-free, high-conductivity.....	OFHC
page(s).....	p. (pp.)
parts per million.....	ppm

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pascal (N/m<sup>2</sup>).....Pa  
 pascal-second.....Pa·s  
 percent.....(See Section 3.10.1)  
 phot (=10<sup>4</sup> lux).....Ph  
 photomultiplier tube.....PM  
 picofarad.....pF (not μF)  
 picogram.....pg  
 poise.....P  
 potential difference.....PD  
 potential energy.....PE  
 pressure, volume, temperature.....PVT  
 probable error.....pe  
 proton.....p  
 Public Document Room.....PDR  
 pulses per second.....pps  
 quality factor.....QF  
 radian.....rad  
 radian per second.....rad/s  
 radian per second squared.....rad/s<sup>2</sup>  
 radiochemical.....RC  
 radiofrequency (adj.).....rf  
 real part (of x).....Re(x)  
 reciprocal meter.....(wave)/m  
 reciprocal ohm.....mho  
 reference(s).....Ref. (Refs.)  
 relative biological effectiveness.....RBE  
 (of radiation)  
 relative humidity.....RH  
 relative ionospheric opacity meter.....riometer  
 relative percent.....spell out  
 relative standard deviation.....RSD  
 revolutions per second.....rps  
 Roentgen.....R  
 Roentgen equivalent man.....rem  
 root mean square.....rms  
 second.....s  
 section(s).....Sec. (Secs.)  
 siemens (A/V).....S  
 sign.....sgn  
 silicon-controlled rectifier.....SCR  
 soluble.....sol  
 solution.....soln  
 south.....S  
 specific activity.....sp act.  
 specific gravity.....sp gr  
 specific heat.....sp ht  
 specific volume.....sp vol  
 speed of light.....c  
 square.....sq  
 square centimeter.....cm<sup>2</sup>  
 square kilometer.....km<sup>2</sup>  
 square meter.....m<sup>2</sup>  
 square meter per second.....m<sup>2</sup>/s

square millimeter.....mm<sup>2</sup>  
 standard.....std  
 standard deviation.....std dev  
 standard temperature and pressure.....STP  
 steradian.....sr  
 stokes.....St  
 tap (1 dyn-s/cm<sup>2</sup>).....spell out  
 temperature.....temp  
 tesla (Wb/m<sup>2</sup>).....T  
 theoretical.....theoret  
 thermocouple.....TC  
 thermoluminescent detector.....TLD  
 thin-layer chromatography.....TLC  
 trace.....Tr  
 transverse acoustic.....TA  
 transverse optic.....TO  
 triton.....t  
 tuballoy.....spell out  
 ultraviolet.....uv  
 velocity.....v  
 versus.....vs  
 Vickers diamond hardness.....Vdh  
 volt (W/A).....V  
 volt-ampere.....VA  
 volt per meter.....V/m  
 volts, alternating current.....Vac  
 volts, direct current.....Vdc  
 volume.....vol  
 volume percent.....spell out  
 volume per volume.....v/v  
 watt (J/s).....W  
 watt per meter kelvin.....W/(m·K)  
 watt per steradian.....W/sr  
 weber.....Wb  
 week.....wk  
 weight.....wt  
 weight percent.....spell out  
 weight-to-volume ratio.....W/V  
 weight-to-weight ratio.....W/W  
 west.....W  
 year.....yr

### 3. ELEMENT ABBREVIATIONS

<u>Name</u>	<u>Symbol</u>	<u>Name</u>	<u>Symbol</u>
actinium	Ac	bismuth	Bi
aluminum	Al	boron	B
americium	Am	bromine	Br
antimony	Sb	cadmium	Cd
arsenic	As	calcium	Ca
astatine	At	californium	Cf
barium	Ba	carbon	C
berkelium	Bk	cerium	Ce
beryllium	Be	cesium	Cs

<u>Name</u>	<u>Symbol</u>
chlorine	Cl
chromium	Cr
cobalt	Co
copper	Cu
curium	Cm
dysprosium	Dy
einsteinium	Es
erbium	Er
europium	Eu
fermium	Fm
fluorine	F
francium	Fr
gadolinium	Gd
gallium	Ga
germanium	Ge
gold	Au
hafnium	Hf
helium	He
holmium	Ho
hydrogen	H
indium	In
iodine	I
iridium	Ir
iron	Fe
krypton	Kr
lanthanum	La
lawrencium	Lr
lead	Pb
lithium	Li
lutetium	Lu
magnesium	Mg
manganese	Mn
mendelevium	Md
mercury	Hg
molybdenum	Mo
neodymium	Nd
neon	Ne
neptunium	Np
nickel	Ni
niobium	Nb
nitrogen	N
nobelium	No
osmium	Os

<u>Name</u>	<u>Symbol</u>
oxygen	O
palladium	Pd
phosphorus	P
platinum	Pt
plutonium	Pu
polonium	Po
potassium	K
praseodymium	Pr
promethium	Pm
protactinium	Pa
radium	Ra
radon	Rn
rhenium	Re
rhodium	Rh
rubidium	Rb
ruthenium	Ru
samarium	Sm
scandium	Sc
selenium	Se
silicon	Si
silver	Ag
sodium	Na
strontium	Sr
sulfur	S
tantalum	Ta
technetium	Tc
tellurium	Te
terbium	Tb
thallium	Tl
thorium	Th
thulium	Tm
tin	Sn
titanium	Ti
tungsten	W
uranium	U
vanadium	V
xenon	Xe
ytterbium	Yb
yttrium	Y
zinc	Zn
zirconium	Zr

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#### 4. THE GREEK ALPHABET

<u>Greek Letter</u>	<u>Lower Case</u>	<u>Upper Case</u>	<u>Greek Letter</u>	<u>Lower Case</u>	<u>Upper Case</u>
alpha	$\alpha$	A	nu	$\nu$	N
beta	$\beta$	B	xi	$\xi$	$\Xi$
gamma	$\gamma$	$\Gamma$	omicron	$\omicron$	O
delta	$\delta$	$\Delta$	pi	$\pi$	$\Pi$
epsilon	$\epsilon$	E	rho	$\rho$	P
zeta	$\zeta$	Z	sigma	$\sigma$	$\Sigma$
eta	$\eta$	H	tau	$\tau$	T
theta	$\theta$	$\Theta$	upsilon	$\upsilon$	$\Upsilon$
iota	$\iota$	I	phi	$\phi$	$\Phi$
kappa	$\kappa$	K	chi	$\chi$	$\chi$
lambda	$\lambda$	$\Lambda$	psi	$\psi$	$\Psi$
mu	$\mu$	M	omega	$\omega$	$\Omega$

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## APPENDIX C

### MATHEMATICS IN A REPORT

#### 1. INTRODUCTION

This appendix is an expansion of Section 7 of the style guide. It provides guidance for the use of numbers and metric units in a report.

#### 2. WRITING NUMBERS

##### 2.1 When to Use Numerals

##### 2.1.1 Units of Measure

Express units of measure or time in numerals. Never begin a sentence with a numeral, however.

##### 1. Measure

7 m	3.5 ℓ, 3.5 liters, or 3.5 L*
1.5 kg	10 A
3 MeV	50 m/s
36 K	13.5° (angle)
17.5 s	50 000 units (but 5000 o: 5 000 units; see also Section 3.4.4.4 in this appendix)

##### 2. Mathematical expressions

multiplied by 3  
divided by 14  
a factor of 5  
integrated from 0 to 1  
i-values of 1, 2, and 3

##### 3. Decimals

Put a zero before the decimal point in numbers less than one, but omit zeros and the decimal point unless there are significant digits to follow the decimal point.

0.25 mm, 1.25 mm  
specific gravity, 0.9547  
gauge height, 10 m, but 10.25 m

\*The National Bureau of Standards has adopted the capital L as the abbreviation for liter; NRC finds this usage acceptable.



#### 4. Percentages

Use a percent symbol only when it is preceded by a numeral.

#### 5. Proportions

1 to 4  
1:62 500  
1/3/5 of powder/alcohol/water

#### 6. Times

6 h  
3955 s  
20 min  
10 yr  
90 days

but: four centuries  
three decades  
statistics of any one year  
in a year or two

#### 7. Clock times and dates

0800  
1400  
4:30 p.m.  
10 o'clock or 10 p.m. (not 10 o'clock p.m.)  
12 m. (noon), 12 p.m. (midnight)  
July 4, 1976, not July 4th 1976  
the 1st (day) of the month,

but: the last of April or the first of May  
(not referring to specific days)  
January 31, 1976, but January 1976 (no comma)  
31 January 1976 (also acceptable)

#### 2.1.2 Sentence Containing Only One Number

If a sentence contains only one number, one that is not discussed in Section 2.1.1, use a numeral if it is 10 or more; spell it out if it is less than 10. (EXCEPTION: Always spell out a number when it is the first word of a sentence; see also Sections 2.1.3 and 2.1.4 in this appendix.)

...saw seven men...  
...drove 24 horses...

but: Seventeen students took the test.  
Twelve 2-kg packages were stacked on each pallet.

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### 2.1.3 Sentences With Two or More Numbers

If a sentence contains two or more numbers (not units of measurement) of which at least one number is 10 or greater, use numerals for all of them. Otherwise, spell them all out. (Note that the sentence is the unit within which to reconcile the conflicting rules for numbers as large as and smaller than 10.) For example:

Each of 15 major commodities, 9 metal and 6 nonmetal, was available.

Each of nine major commodities, five metal and four nonmetal, was available.

Petroleum came from 16 fields, of which 3 were discovered in 1956.

Petroleum came from nine fields, of which eight were discovered in 1956.

Numerals that express units of measurement or time do not affect the handling of other numbers within a sentence. (See preceding Section 2.1.1.) For example:

Each of the five trucks traveled an average of 75 miles.

Each of the 15 trucks traveled an average of 75 miles.

### 2.1.4 Ordinal Numbers

Spell out ordinal numbers (first, second, third) if they are single words; write them as numerals if they are not.

He represented the second and ninth wards.

He served in the 95th congress.

Be consistent in expressing ordinal and cardinal numbers that appear together in a sentence. For example:

The fourth group contained three items.

The fourth group contained 12 items.

The eighth and ninth groups contained 9 and 12 items, respectively.

### 2.2 When to Spell Out Numbers

Spell out any number that appears at the beginning of a sentence or heading. If this causes conflict with other rules given here, rephrase the sentence or heading to avoid beginning with a number.

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Five years ago  
Five-year plans are lagging.  
Four hundred and fifty men are employed.  
(Consider changing to: Employees number 450.)  
Sixty-six horses, twenty-nine men, and nine guns  
were captured. (Consider changing to: Losses  
were 66 horses, 29 men, and 9 guns.)

Do not repeat a spelled-out number as a numeral in parentheses.

Spell out numbers less than 100 that precede a compound modifier containing a numeral.

twelve 2-kg packages  
ninety-three 5-m-wide crates  
five 2400-L/s pumps

Spell out rounded and approximate numbers.

a hundred people  
less than a million  
about a million dollars (but \$2 million)

### 2.3 Hyphenation of Numbers

Hyphenate between numbers and words that combine to form a unit modifier preceding the word that is modified. (See also Section 7.1 of Appendix E.)

1-mm diam  
10-mm-diam rod (but a rod 10 mm in diameter)  
6-m-long board (but a board 6 m long)  
five-member panel  
10-fold increase (but threefold, ninefold)

When two or more hyphenated compounds in series have a common base element that is omitted in all but the first or last one, retain the hyphen to indicate suspension.

2- to 5-mm-thick sheets  
2- or 3-mm tubing, not 2 or 3-mm tubing  
2- by 4-mm sheets, but sheets 2 by 4 mm in cross section  
8-, 10- and 16-m beams

Hyphenate between the elements of spelled-out compound numbers from 21 to 99.

twenty-one  
thirty-seven  
eighty-two  
ninety-nine

Hyphenate between the numerator and denominator of a spelled-out fraction, except when one or the other already contains a hyphen.

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one-half  
 two-thirds  
 one-hundredth  
 two one-thousandths or two-thousandths

In listings, hyphenate, and use in the singular, unit modifiers following and reading back to the item modified.

motor: ac, three-phase, 60-cycle, 115-V,  
not motor: ac, three phases, 60 cycles, 115 V  
 glass jars: 5-L, 2-L, 250-mL  
 belts: 2-m, 30-mm, 40-mm

Do not hyphenate a modifier consisting of a number followed by a possessive noun such as 2 months' layoff, 1 day's pay, or seven men's labor.

### 3. METRIC UNITS

#### 3.1 International System (SI) of Units

The NRC will eventually convert to predominant, but not necessarily exclusive, use of the modernized metric system--the International System of Units (SI). Some NRC components (Office of Standards Development and Division of Site Safety and Environmental Analysis, NRR) have already established policies for the use of SI units by members of their staffs. In the absence of an established policy, the use of dual units (with the SI unit first followed by the conventional unit in parentheses) or SI units alone is encouraged. SI radiological units, however, should not be used alone until they have been adopted in NRC regulations.

The standard authority on SI units is National Bureau of Standards Special Publication 330, "The International Systems of Units (SI)." The American Society for Testing and Materials publication ASTM E 380-76, "ASTM/IEEE Standard Metric Practice," is recommended as a source of rules on style and use of SI units, conversion and rounding, handling of tolerances, etc. (Both of these publications are listed in the bibliography at the end of this appendix.)

Standard SI prefixes are given in the following list. The prefixes hecto-, deka-, deci-, and centi- are not recommended except for expressing area and volume.

<u>Exponent</u>	<u>Prefix</u>	<u>SI Symbol</u>	<u>Exponent</u>	<u>Prefix</u>	<u>SI Symbol</u>
10 <sup>18</sup>	exa	E	10 <sup>-1</sup>	deci	d
10 <sup>15</sup>	peta	P	10 <sup>-2</sup>	centi	c
10 <sup>12</sup>	tera	T	10 <sup>-3</sup>	milli	m
10 <sup>9</sup>	giga	G	10 <sup>-6</sup>	micro	μ
10 <sup>6</sup>	mega	M	10 <sup>-9</sup>	nano	n
10 <sup>3</sup>	kilo	k	10 <sup>-12</sup>	pico	p
10 <sup>2</sup>	hecto	h	10 <sup>-15</sup>	femto	f
10	deka	da	10 <sup>-18</sup>	atto	a

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### 3.2 Base and Supplementary Units

<u>Quantity</u>	<u>Unit</u>	<u>SI Symbol</u>
Base Units		
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd
Supplementary Units		
Plane angle	radian	rad
Solid angle	steradian	sr

### 3.3 Derived Units

<u>Quantity</u>	<u>Unit</u>	<u>SI Symbol</u>	<u>Formula</u>
absorbed dose	gray	Gy	J/kg
acceleration	meter per second squared		m/s <sup>2</sup>
activity (radioactive)	becquerel	Bq	s <sup>-1</sup>
activity (radioactive)	disintegration per second		dis/s
angular acceleration	radian per second squared		rad/s <sup>2</sup>
angular velocity	radian per second		rad/s
area	square meter		m <sup>2</sup>
density	kilogram per cubic meter		kg/m <sup>3</sup>
dose equivalent	sievert	Sv	J/kg
electric capacitance	farad	F	A·s/V
electrical conductance	siemens	S	A/V
electric field strength	volt per meter		V/m
electric inductance	henry	H	V·s/A
electric potential difference	volt	V	W/A
electric resistance	ohm	Ω	V/A
electromotive force	volt	V	W/A
energy	joule	J	N·m
entropy	joule per kelvin		J/K
force	newton	N	kg·m/s <sup>2</sup>
frequency	hertz	Hz	s <sup>-1</sup>
illuminance	lux	lx	lm/m <sup>2</sup>
luminance	candela per square meter		cd/m <sup>2</sup>
luminous flux	lumen	lm	cd·sr

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<u>Quantity</u>	<u>Unit</u>	<u>SI Symbol</u>	<u>Formula</u>
magnetic field strength	ampere per meter		A/m
magnetic flux	weber	Wb	V·s
magnetic flux density	tesla	T	Wb/m <sup>2</sup>
magnetomotive force	ampere	A	
power	watt	W	J/s
pressure	pascal	Pa	N/m <sup>2</sup>
quantity of electricity	coulomb	C	A·s
quantity of heat	joule	J	N·m
radiant intensity	watt per steradian		W/sr
specific heat	joule per kilogram-kelvin		J/kg·K
stress	pascal	Pa	N/m <sup>2</sup>
thermal conductivity	watt per meter-kelvin		W/m·K
velocity	meter per second		m/s
viscosity, dynamic	pascal-second		Pa·s
viscosity, kinematic	square meter per second		m <sup>2</sup> /s
voltage	volt	V	W/A
volume	cubic meter		m <sup>3</sup>
wave number	reciprocal meter		(wave)/m
work	joule	J	N·m

### 3.4 Style and Usage

#### 3.4.1 General

Avoid use of mixed units, especially those compounded from different systems. For example, use kilogram per cubic meter (kg/m<sup>3</sup>), not kilogram per gallon (kg/gal), and use 0.1789 rad or 10.25 deg, not 10 deg 15 min.

#### 3.4.2 Application of Prefix

##### 3.4.2.1 General

Use metric prefixes to indicate orders of magnitude, thus eliminating insignificant digits and decimals and providing a convenient substitute for writing powers of 10 as generally preferred in computation. For example, 12 300 m or 12.3x10<sup>3</sup> m becomes 12.3 km and 0.0123 μA or 12.3x10<sup>-9</sup> A becomes 12.3 nA.

##### 3.4.2.2 Selection

Use multiple and submultiple prefixes representing steps of 1000. For example, show force in mN, N, and kN and length in mm, m, km, etc. When expressing a quantity by a numerical value and a unit, try to choose prefixes such that the numerical value lies between 0.1 and 1000, except where certain multiples or submultiples have been agreed to for particular use. The same unit, multiple, or submultiple is used for tabular values even though the series exceeds the preferred range 0.1 to 1000.

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### 3.4.2.3 Double Prefixes

Do not use double prefixes. For example, use GW (gigawatt), not kMW, use pF (picofarad), not  $\mu\mu\text{F}$ , and use Gg (gigagram), not Mkg.

### 3.4.2.4 Compound Units

Use only one prefix in forming a compound unit. Normally the prefix should be attached to a unit in the numerator. An exception occurs when one of the units is the kilogram.

### 3.4.2.5 Higher Order Metric Units

With metric units of higher order such as  $\text{m}^2$  and  $\text{m}^3$ , raise the prefix to the same order (that is,  $\text{mm}^3$  is  $10^{-9} \text{m}^3$  not  $10^{-3} \text{m}^3$ ).

### 3.4.3 Use of SI Units

#### 3.4.3.1 Length

Nominal dimensions merely name the item, and no SI equivalent of the name is required.

Nominal Size (in.)	Outside Diameter [in. (mm)]	Wall Thickness [in. (mm)]		
		Sch 40	Sch 80	Sch 160
1	1.315 (33.40)	0.133 (3.38)	0.179 (4.55)	0.250 (6.35)

Likewise, the name "2 by 4" refers only to the approximate dimensions in inches of a rough-sawed, green piece of timber, the finished dimensions of which are considerably smaller. A 1/4-20 UNC screw thread should continue to be so identified. However, the controlling dimensions of the part, such as the pitch and major and minor diameters of a screw thread, should be converted to SI values. Convert threads per inch to millimeter pitch.

When a dimension such as wire diameter or sheet thickness is expressed by a gauge number, give the appropriate gauge system (for example, American Wire Gauge or AWG) and the corresponding SI value.

Convert surface finish expressed in microinches to micrometers ( $\mu\text{m}$ ).

#### 3.4.3.2 Temperature

The SI temperature scale is the International Thermodynamic Temperature Scale, and the unit used for expressing temperature and temperature intervals is the Kelvin. However, the degree Celsius has wide use, particularly in engineering and in nonscientific areas, and it is permissible to use the Celsius scale where considered necessary. The Celsius scale (formerly called the centigrade scale) is related directly to the Kelvin scale as follows:

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One degree Celsius equals one degree Kelvin, exactly.  
A Celsius temperature ( $^{\circ}\text{C}$ ) is related to a Kelvin temperature (K) as  $K = 273.15 + ^{\circ}\text{C}$ , exactly.

#### 3.4.3.3 Time

The SI unit for time is the second. This unit is preferred and should be used when practicable. In other cases, use minute, hour, day, etc.

#### 3.4.3.4 Angles

The SI unit for plane angle is the radian. Use the arc degree and its decimal submultiples when the radian is not a convenient unit. Express solid angles in steradians.

#### 3.4.3.5 Stress and Pressure

The SI unit for pressure and stress is the pascal (newton per square meter).

### 3.4.4 Style

#### 3.4.4.1 Capitalization

Do not capitalize symbols for SI units unless the unit is derived from a proper name; thus, Hz for H. R. Hertz, but m for meter. Do not capitalize unabbreviated units such as hertz, newton, and kelvin. Do not capitalize numerical prefixes and their symbols, except for the symbols M, G, T, P, and E.

#### 3.4.4.2 Plurals

Unabbreviated SI units form their plurals in the usual manner. Always write SI symbols in singular form; for example,

50 newtons is 50 N, and  
25 grams is 25 g.

#### 3.4.4.3 Punctuation

Do not use periods after SI unit symbols except at the ends of sentences.

#### 3.4.4.4 Number Grouping

To facilitate reading numbers of four or more digits, place the digits in groups of three separated by spaces instead of commas, counting both to the left and to the right of the decimal point. When there are four digits, the spacing is optional. This style also avoids confusion caused by the European use of commas to express decimal points. For example, the following samples show the preferred usage:

1 532 or 1532 instead of 1,532  
132 541 816 instead of 132,541,816  
933 769.816 78 instead of 983,769.81678

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#### 3.4.4.5 Derived Units

In derived unit symbols, use the center dot or a space to indicate multiplication and a slash to indicate division. Symbols to the left of the slash are in the numerator and those to the right are in the denominator. Only one slash should be used unless parentheses are included to avoid ambiguity. If typing a center dot creates problems, a hyphen may be used instead.

### 4. EQUATIONS

#### 4.1 Units of Measure Within Equations

When U.S. customary units appear in equations, omit the SI equivalents. Instead of inserting the SI equivalents in parentheses as in text or small tables, restate the equations using SI quantities or add a sentence, paragraph, or footnote stating the factor to be used to convert the calculated result in U.S. units equivalent to the preferred SI units.

#### 4.2 Displayed Equations

Type mathematical equations, rather than write by hand, for simplicity and clarity in the reproduction process. Equations may be typed centered on the page, tabbed in from the left margin, or flush left with the rest of the text. If mathematical symbols and Greek letters are not available with the typing equipment, use commercially produced press-on letters and symbols. If press-on material is unavailable, handprint letters and symbols preferably with ink. Allow sufficient space within a basic typewritten equation to accommodate any press-on or handwritten symbols or letters.

Align a series of equations (not separated by text) by equality signs and place them to give the appearance of being centered as a whole (Ref. 4) or tab in and align by equality signs. Consider the following sample:

$$C_m = \frac{1}{b} [\exp(bu) - 1] \exp(-au) \quad (1)$$

where

$$a = \lambda_1/\lambda_2$$

$$b = a - K_2/K_1$$

$$u = \lambda_2 K_1 x/V$$

$$\lambda_i = \text{decay constant for parent (i=1) or daughter (i=2) (yr}^{-1}\text{)}$$

$$K_i = \text{sorption coefficient}$$

$$x = \text{aquifer path length (1,000 m)}$$

$$V = \text{aquifer velocity (100 m/yr)}$$

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Note that the equation number (enclosed by parentheses) is displayed on the same line as the main line of the equation and is placed flush with the right margin. Also note that punctuation is not necessary with displayed equations.

There are occasions when short equations or formulas can be run in the text to save space. However, take care to prevent superscript or subscript letters or numbers from running into preceding or following text. A half-line of space can also be used preceding and following a text line including an equation to prevent any overrunning of text or equation components.

When a line of equations is wider than a full line of text, break it at the equality sign or an operation sign. In chemical formulas, break the lengthy line at the arrow.

## 5. BIBLIOGRAPHY

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## APPENDIX D

### GUIDELINES FOR CREATING TABLES AND GRAPHICS

#### 1. INTRODUCTION

This appendix presents a brief description of how tables and figures should be prepared for reports. Examples of report tables and figures are also included.

#### 2. TABLES

A table is useful for showing large numbers of specific, related statistics in a brief space. A table can present data in a more concise form than is possible in the text and a table is more accurate than graphic presentations because it provides numerous facts that a graph cannot convey. A table makes comparisons between figures easy because of the arrangement of the figures into rows and columns, although overall trends about the information are more easily seen in charts and graphs. (See Table D.1 for a sample format.)

##### 2.1 Guidelines for Creating Tables

###### 2.1.1 Table Number

If you are using several tables, assign each a specific number; position the number and title above the table. The numbers are usually Arabic, and they should be assigned sequentially to the tables throughout the text. Refer to tables in the text by table number rather than by direction ("Table 4" rather than "the above table"). If there are more than five tables in your report or paper, list them, their captions, and their table and page numbers on a separate page immediately after the Table of Contents, labeled "List of Tables."

###### 2.1.2 Caption

The caption, centered above the table, should describe concisely what the table represents.

###### 2.1.3 Boxhead

The boxhead carries the column headings. These should be kept concise but descriptive. Units of measurement, where necessary, should be specified either as part of the heading or enclosed in parentheses beneath the heading. Avoid vertical lettering where possible.

###### 2.1.4 Stub

The left-hand vertical column of a table is the stub. It lists the items about which information is given in the body of the table, and carries a boxheading only if identification is necessary.

###### 2.1.5 Body

The body comprises the data below the boxhead and to the right of the stub. Within the body, arrange columns so that the terms to be compared appear in

### Sample Table and Its Parts

*Caption* → **Table D.1** Recreational fresh-water angling by water body type and geographical region (in thousands of anglers)\*  
*Table Number* →

<i>Boxhead</i> →	Geographical Regions	Reservoirs	Man-Made Ponds	Natural Lakes & Ponds	Rivers & Streams	Farm Ponds	<i>Column Captions</i> ←
	New England	130	40	570	410	410	<i>Body</i> }
	Middle Atlantic	710	290	780	1200	630	
	East North Central	1200	760	3100	1600	1300	
<i>Stub</i> →	West North Central	810	550	1200	970	980	
	South Atlantic	1100	760	640	1500	1600	
	East South Central	890	630	190	670	1200	
	West South Central	1700	610	430	880	1300	
	Mountain	820	50	280	600	230	
	Pacific	950	200	820	1400	470	
<i>Rule</i> →	Totals	8300	3900	8000	9200	7800	

*Footnote* → \*Anglers who fished in more than one water body or region are represented in more than one category.

*Source Line* → Source: U.S. Department of the Interior

adjacent rows and columns. Where no information exists for a specific item, leave a blank space.

#### 2.1.6 Rules (Lines)

These are the lines that separate the table into its various parts. Horizontal lines are placed below the title, below the body of the table, and between the column headings and the body of the table. They should not be closed at the sides. The columns within the table may be separated by vertical lines if they aid clarity.

#### 2.1.7 Footnotes

Footnotes are used for explanations of individual items in the table. Symbols (\*,#) or lower-case letters rather than numbers are ordinarily used to identify table footnotes because numbers might be mistaken for data in a numerical table.

#### 2.1.8 Source Line

The source line, which identifies where the data were obtained, appears below any footnotes, when appropriate.

#### 2.1.9 Continuing Table

When a table must be divided so that it can be continued on another page, repeat the boxhead and give the table number at the head of each new page with a "continued" label (Table 3, continued).

### 3. GRAPHS

Graphs, like tables, present numerical data in visual form. Graphs have several advantages over presenting data in tables or within the text, however. Trends, movements, distributions, and cycles are more readily apparent in graphs than they are in tables. By providing a means for ready comparisons, a graph often shows a significance in the data not otherwise immediately apparent. Be aware, however, that although graphs present statistics in a more comprehensible form than tables do, they are less accurate. For this reason, they are often accompanied by tables giving exact figures. The kinds of graphs most commonly used in NRC reports are line graphs, bar graphs, and pie graphs.

#### 3.1 Line Graphs

The line graph, most widely used of all graphs, shows the relationship between two sets of numbers by means of points plotted in relation to a vertical and horizontal axis drawn at right angles. Once plotted, the points are connected to one another to form a continuous line, thus making the relationship between the two sets of figures easy to see.

##### 3.1.1 Tips on Preparing Line Graphs

- (1) Give the graph a title that describes the data clearly and concisely.
- (2) Assign a figure number if your report includes more than five illustrations.

- (3) Include a key that lists and explains symbols when necessary. At times a label will do just as well, as in Figure D.1.
- (4) Indicate the zero point of the graph (the point where the two axes meet). If the range of data shown makes it inconvenient to begin at zero, insert a break in the scale as in Figure D.2.
- (5) Divide the vertical axis in equal portions from the least amount at the bottom to the greatest amount at the top, unless it is a log scale. Place the caption for this scale either at the upper left or vertically along the axis.
- (6) Divide the horizontal axis in equal units from left to right. If a caption is necessary, center it directly beneath the scale.
- (7) Divide the vertical and horizontal scales so that they give an accurate visual impression of the data, since the angle at which the curved line rises and falls is determined by the scales of the two axes. The curve can be kept free of distortion if the scales maintain a constant ratio with each other.

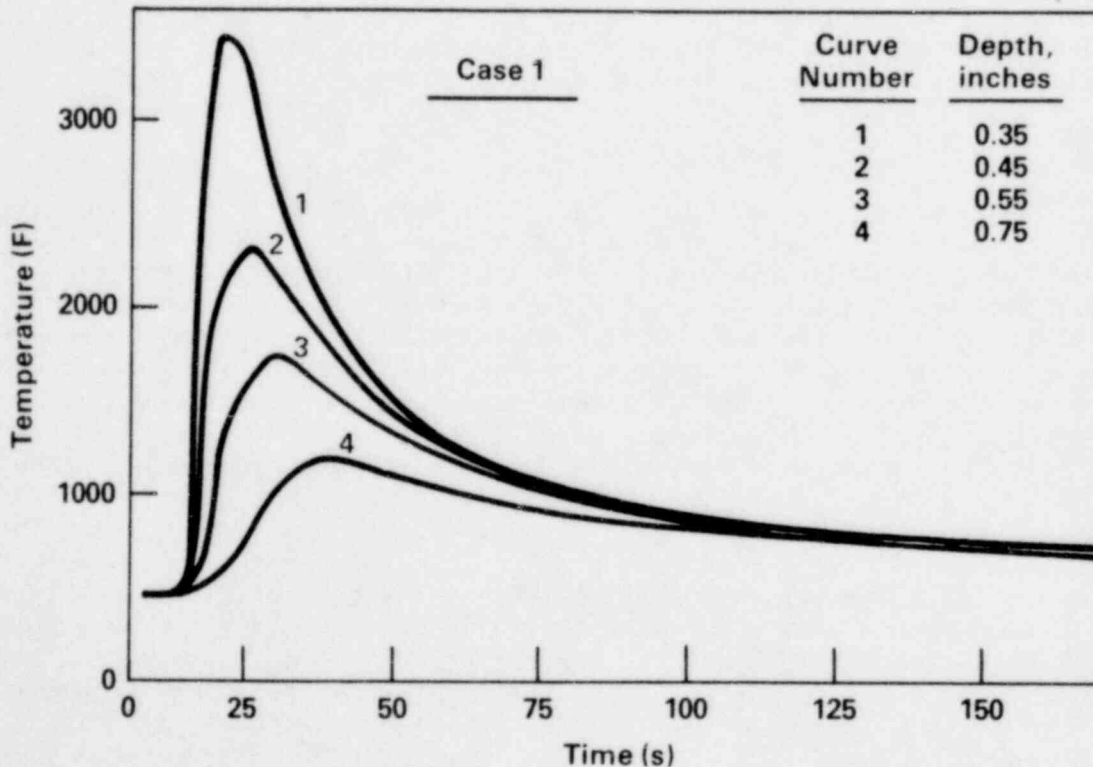


Figure D.1 Temperature histories of various depths below the weld torch for case 1.

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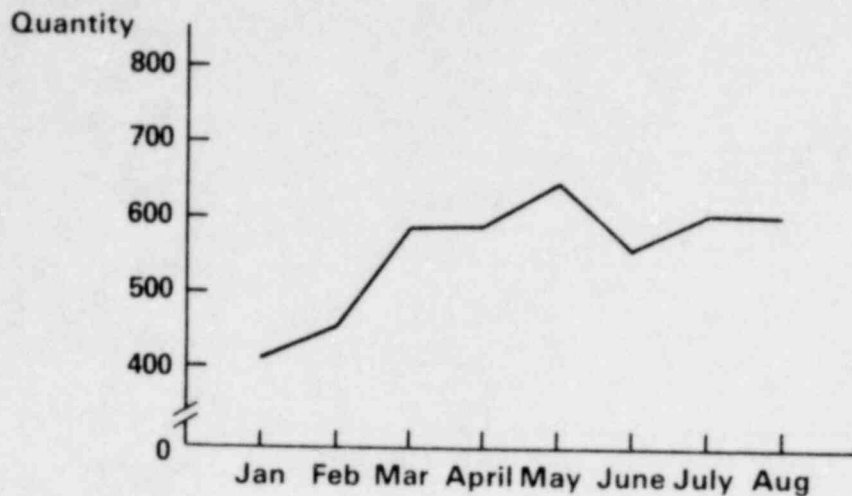


Figure D.2 Widget production for January-August 1979.

- (8) Keep grid lines to a minimum so that curved lines stand out. Since precise values are usually shown in a table of data accompanying a graph, detailed grid lines are unnecessary.
- (9) If the information comes from another source, include a source line below the graph.
- (10) Place explanatory footnotes directly below the figure number.

### 3.2 Bar Graphs

Bar graphs consist of horizontal or vertical bars of equal width but scaled in length to represent some quantity. They are commonly used to show (1) quantities of the same item at different times, (2) quantities of different items for the same time period, or (3) quantities of the different parts of an item that make up the whole.

If the bar is not labeled, the different portions must be marked clearly by shading or crosshatching. Include a key that identifies the various subdivisions, as in Figure D.3.

Bar graphs can also show the different portions of an item that make up the whole. The bar is then equivalent to 100 percent. It is then divided according to the appropriate proportions of the item sampled, as Figure D.4. This type of graph can be constructed vertically or horizontally and can indicate more than one whole where comparisons are necessary, as Figure D.5.

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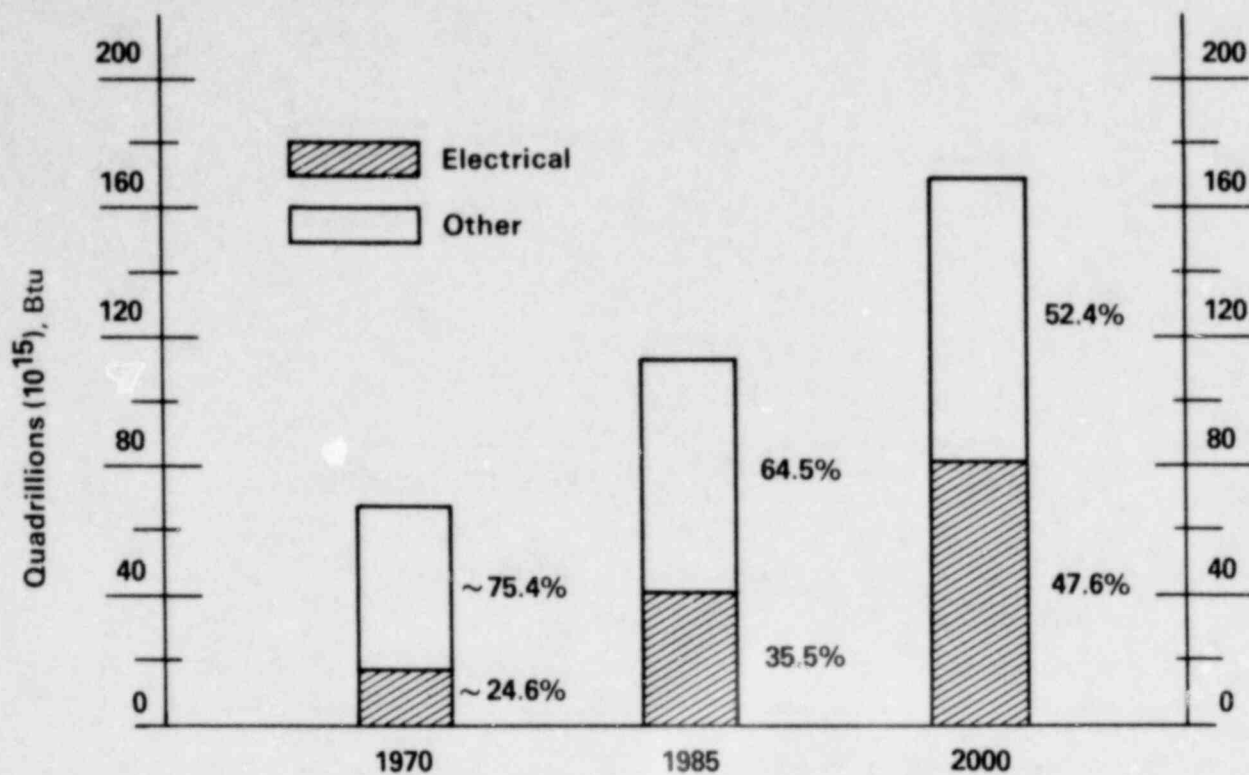


Figure D.3 Total U.S. energy requirements for 1970, 1985 and 2000.

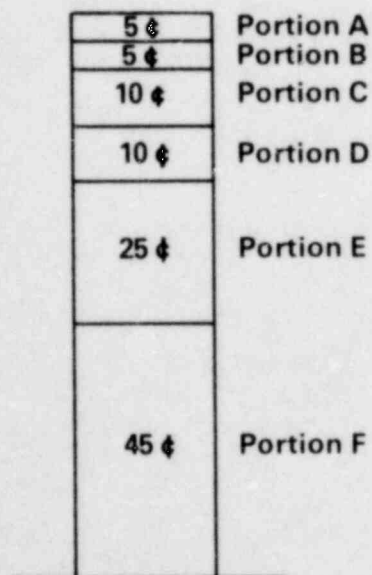


Figure D.4 Your energy dollar.

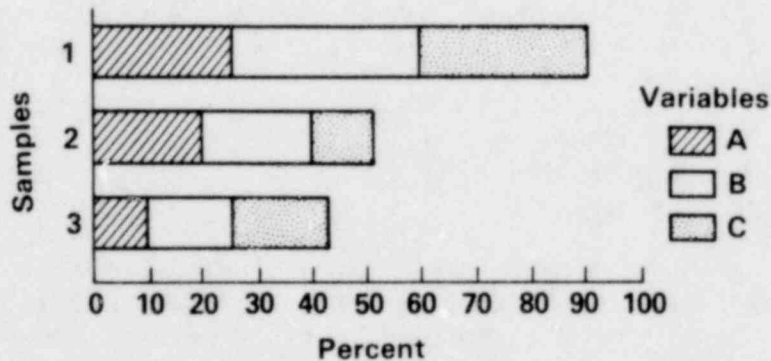


Figure D.5 Example of 100-percent bar graph showing proportions of three variables in three samples.

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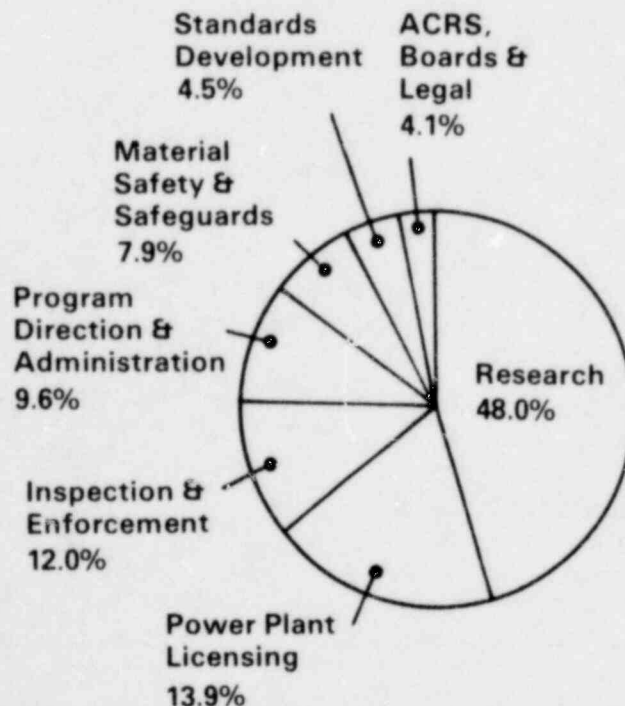
### 3.3 Pie Graphs

A pie graph presents data as wedge-shaped sections of a circle. The circle equals 100 percent, or the whole, of some quantity (a tax dollar, personnel, the hours of a working day), with the wedges representing the various ways in which the whole is divided. In Figure D.6, for example, the circle represents NRC funds for FY 1979. It is divided into units equivalent to the percentage of funds allocated to major program offices and advisory groups.

Pie graphs provide a quick, easy-to-read way of presenting information compared with tables; in fact, a table often accompanies a pie graph with a more detailed breakdown of the same information.

When you construct a pie graph, keep the following things in mind.

- (1) The complete 360° circle is equivalent to 100 percent; therefore, each percentage point is equivalent to 3.6°.
- (2) To make the relative percentages as clear as possible, begin at the 12 o'clock position and sequence the wedges clockwise, from largest to smallest.
- (3) If you shade the wedges, do so clockwise and from light to dark.
- (4) Keep all labels horizontal and, most important, give the percentage values of each wedge.
- (5) Finally, check to see that all wedges, as well as percentage values given for them, add up to 100 percent.



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Figure D.6 NRC funds for FY 1979 - \$331 million.

Although pie graphs have strong visual impact, they also have drawbacks. If more than five or six types of information are presented, the graph looks cluttered. Also, since pie graphs usually present information in percentages, they must often be accompanied by a table listing the figures used to calculate the percentage amounts. Further, unless percentages are labeled on each section, the reader cannot compare the values of the sections as accurately as with a bar graph.

#### 4. MAPS

Maps can be used to show the specific geographic features of the area represented (roads, mountains, rivers, etc.) or to show information according to geographic distribution (population, housing, manufacturing centers, etc.). (See Figure D.7.)

Bear these points in mind as you create maps for use with your text.

- (1) Label the map clearly.
- (2) Assign the map a figure number if you are using enough illustrations to justify use of figure numbers.

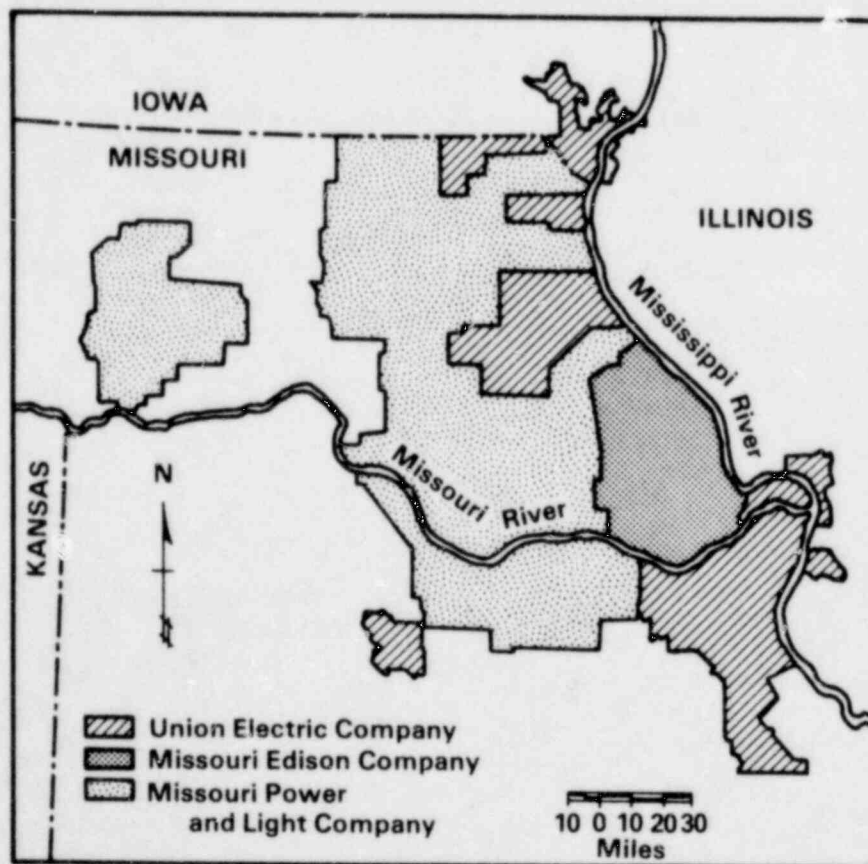


Figure D.7 Location of service area of three utilities.

- (3) Make sure all boundaries within the map are clearly identified. Eliminate unnecessary boundaries.
- (4) Eliminate unnecessary information from your map. For example, if population is important, do not include mountains, roads, rivers, etc..
- (5) Include a scale of miles or feet to give your reader an indication of the map's proportions.
- (6) Indicate which direction is north.
- (7) Show the features you want emphasized by shading, dots, crosshatching or use of appropriate symbols when color reproduction cannot be used.
- (8) If you use only one color, only three shades of a single color will show up satisfactorily.
- (9) Include a key telling what the different colors, shadings, or symbols represent.
- (10) Place maps as close as possible to the portion of the text that refers to them.

## 5. DRAWINGS

A drawing is useful when you wish to focus on details or relationships that a photograph cannot capture. A drawing can emphasize the significant piece of a mechanism, or its function, and omit what is not significant. However, if the precise details of the actual appearance of an object are necessary to your report or document, a photograph is essential. Tips for creating and using drawings follow:

- (1) Give the drawing a clear title and a figure number, both of which should be centered below the drawing.
- (2) Place the source line, if necessary, in the lower left corner.
- (3) Show the equipment from the point of view of the person who will use it.
- (4) When illustrating a subsystem, show its relationship to the larger system of which it is a part.
- (5) Draw the different parts of an object in proportion to one another, unless you indicate that certain parts are enlarged.
- (6) Where a sequence of drawings is used to illustrate a process, arrange them from left to right.
- (7) Label parts in the drawing so that text references to them are clear.
- (8) Depending on the complexity of what is shown, labels may be placed on the parts themselves, or the parts may be given letter or number symbols, with an accompanying key. (See Figure D.8.)

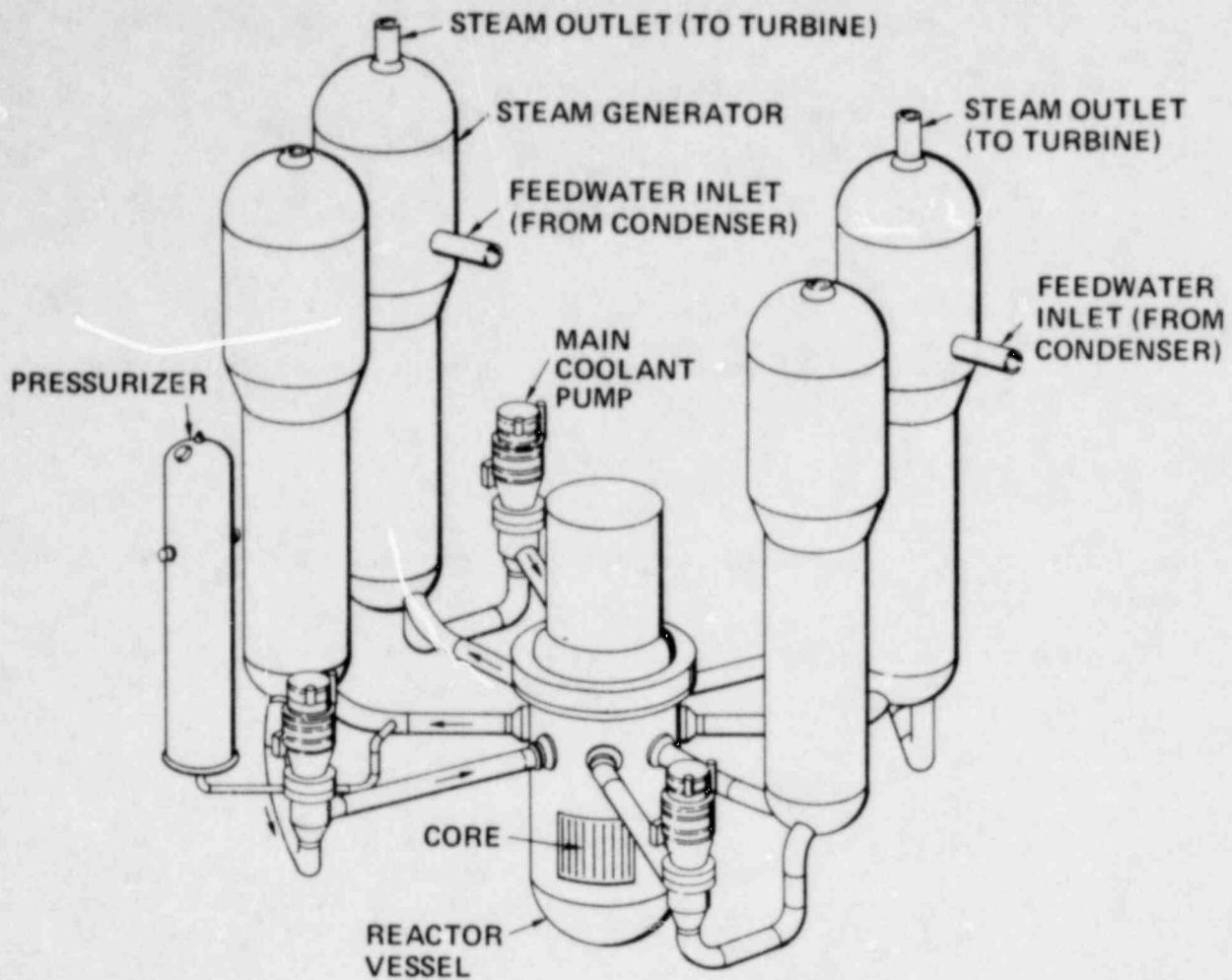


Figure D.8 Reactor coolant system for PWR.

## 6. FLOWCHARTS

A flowchart is a diagram of a process that involves stages, with the sequence of stages shown from beginning to end. Figure D.9 illustrates the cooling cycles of a PWR.

When creating flowcharts, observe the following guidelines:

- (1) Title the flowchart clearly.
- (2) Label each step in the process, or identify it with a conventional symbol. Steps can also be represented pictorially or in captioned blocks.
- (3) Use arrows to show the directions of flow.

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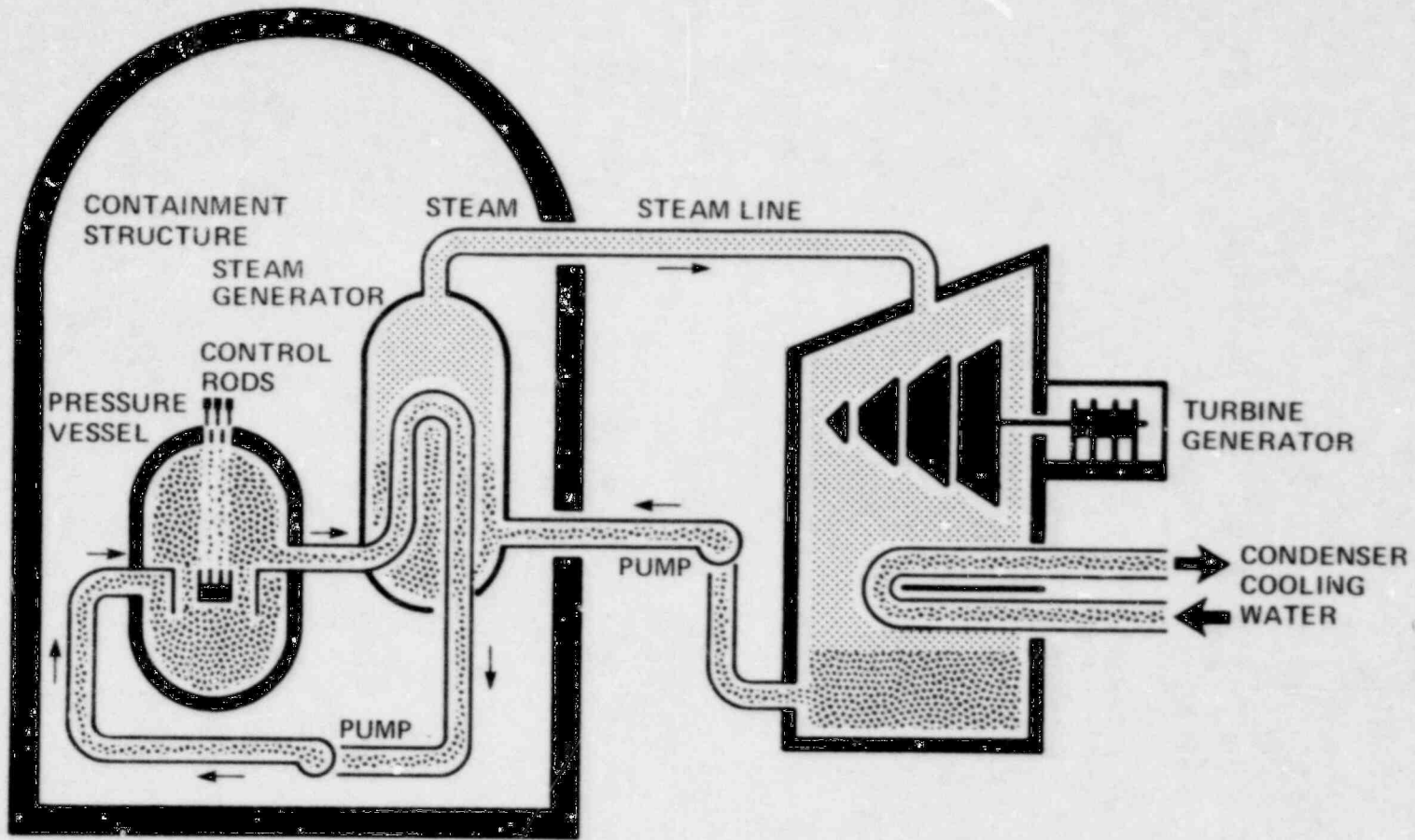


Figure D.9 Pressurized water reactor (PWR) cooling cycles.

- (4) Include a key if the flowchart contains symbols your reader may not understand.
- (5) Leave adequate white space on the page. Do not position your steps and directional arrows too close together.
- (6) As with all illustrations, place the flowchart as close as possible to that portion of the text that refers to it.
- (7) Assign a figure number if the report contains more than five illustrations.

## 7. PHOTOGRAPHS

Photographs are useful for showing objects or phenomena that are new or unusual, that are at a particular stage of development, that exhibit wear, damage, or the significance of a particular setting, etc. As you create or select photographs, consider the camera angle carefully so that the photograph shows only what is essential. When submitting photographs with the report manuscript, keep the following guidelines in mind:

- (1) Submit high-contrast glossy black and white photographs only. Do not submit color photographs.
- (2) Provide a figure number and caption. Photographs are considered figures and are therefore given figure numbers in sequence with the other illustrations in a report.
- (3) Mount photographs on white bond paper with rubber cement and provide ample margins.
- (4) If the photograph is the same size as the report page, type the caption, figure and page numbers and any labels for important points on pieces of paper and glue them to the photograph with rubber cement.
- (5) If the orientation of the photograph is not obvious at a glance, position the figure number and caption so that they can be read while the photograph is being viewed from the proper orientation.
- (6) Place a familiar object, such as a ruler or other scale, in the foreground to show relative size.
- (7) On photomicrographs, show a scale (\_\_\_ mm) or give the true magnification in the caption. Photomicrographs whose magnification is given in the caption should not be reduced.
- (8) If the photograph must be cropped, mark the crop lines at the edges of the photograph. Do not draw a line directly across a photograph.
- (9) Do not use paper clips directly on a photograph. Protect the photographs with heavy paper or light cardboard.
- (10) Do not fold or crease photographs.

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## 8. SPECIAL GRAPHICS

Use oversized illustrations, such as engineering drawings, only when no acceptable substitutes for them are available. Such illustrations are difficult and expensive to reproduce. When they must be used, assign them figure numbers and captions as you would any other illustration.

For instructions about their use and special handling, contact the Policy and Publications Management Branch of the Division of Technical Information and Document Control.

## 9. BIBLIOGRAPHY

Brusaw, C. T., G. J. Alred, and W. E. Oliu. Handbook of Technical Writing. New York: St. Martin's Press, 1976. Available from St. Martin's Press, Inc., 175 Fifth Ave., New York, NY 10010.

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APPENDIX E  
REPORT MECHANICS

1. INTRODUCTION

This appendix provides guidance on chapter dividers, type of paper to be used, document appearance and page numbering, and preferred spelling and usage. Attention to details such as these provides another degree of consistency in NRC documents.

2. APPEARANCE

2.1 Typing Instructions

Type paragraphs single spaced, flush left in block style (no paragraph indentations). Double space between paragraphs and double space before and after headings. This document is typed in block style.

2.2 Margins (Image Area)

The contents of the document should be printed within the image area of each page. The image area is the area on the page bounded by the margins on each edge of the paper. The top, bottom, and right-hand margins should each be one-inch wide. The right and left-hand margins should be one and one-fourth inches wide.

2.3 Photocopied Text

In the event that duplicate copies of the report are made, each copy should have qualities similar to those of the original; that is, the copied characters should be complete, with no light patches on the page. Pages reproduced by photocopying machines are not acceptable as camera-ready material. Photographically reproduced pages (using photographic print paper) are acceptable.

3. PAGINATION

Number all pages of draft and final reports. Paginate consecutively throughout, with small Roman numerals for all front matter and Arabic numerals for the text, the reference section, bibliography, appendixes, etc. If the organization of a document is clarified by pagination within each section of the text, number the front matter pages with small Roman numerals and text pages with arabic numerals using the double-numbering method (for example, 1-4 or 5-25). Final reports are printed on both sides of the paper; therefore, all left-hand pages must carry even numbers, and all right-hand pages, odd numbers.

New chapters may begin on a new left- or right-hand page. Page numbers should be centered one-half inch above the bottom of the typing guide.

4. PAPER

Use plain, white, bond paper without company or agency letterhead or logo.

## 5. CHAPTER DIVIDERS

The use of colored paper or heavier weight paper as chapter dividers for final documents is discouraged. Although there are several ways of incorporating separating devices in a bound text, the most reasonable divider (least costly in time of preparation as well as money) is a margin thumb index in which a solid printed mark (much like a tab) bleeds\* to the outside edge of the paper. This type of index is often keyed on the back of the outside cover of a publication. If this be the case, the bleeding margin index is printed on the left margin of a left-hand page of the divider area or sheet.

## 6. SPELLING

The authorities used by NRC for spelling, usage, and word division are Webster's Third New International Dictionary and the GPO Style Manual.

## 7. PREFERRED USAGE

### 7.1 Compounding and Hyphenation

Compound words are combinations of two or more words that are written either as one word or hyphenated: man-year, greenhouse, light-year. To determine whether a compound word should or should not be hyphenated, check a recent edition of an office dictionary. For a concise discussion of general rules for compounding, see the GPO Style Manual, Chapters 6 and 7.

When applying the general rules for compounding to nuclear engineering, the following terms are not usually hyphenated: critical heat flux, fast flux test facility, nuclear steam supply system, or radioactive waste disposal classification system. However, chemical elements used in combination with numbers (uranium-235) or chemical formulas (Cr-Ni-Mo) require hyphens. A hyphen is also required with elements of technical compound units of measurement, such as kilowatt-hour, volt-ampere, centimeter-gram-second.

Be careful to distinguish between compound words and unit modifiers. Use hyphens in unit modifiers: gas-cooled reactor, full-scale test, loss-of-coolant accident.

### 7.2 Word Usage

This section provides guidance to the correct use of frequently misused words and expressions.

#### accuracy, precision

Accuracy is the agreement between the true value and the result obtained by measurement.

\*The ink is intentionally printed to the outside edge of the paper, thus providing easily visible divider marks.



Precision is the agreement among repeated measurements of the same quantity.

activate, actuate

Both words mean "to make active," although actuate is usually applied only to mechanical processes.

Example: The relay actuates the trip hammer.

Activate has a wide range of applications to chemical processes, all of which apply to nuclear science: to make (something) radioactive, luminescent, photosensitive, photoconductive, more adsorptive, etc.

affect, effect

Affect is a verb that means to influence.

Example: The Commission's decision affected all licensees.

Effect can function either as a verb that means to bring about or to cause, or as a noun that means a result.

Examples: The Chief effected several changes in the Branch that had a good effect on morale.

Avoid using effect as a verb. A less pompous-sounding substitute, like made, is preferable.

alternate, alternative

To alternate (verb) is to occur in successive turns.

An alternative (noun) is a choice among mutually exclusive objectives or courses of action.

analyze, determine, identify

To analyze is to separate into parts so as to determine the nature of the whole.

To determine is to ascertain definitely, as after an investigation or calculation.

To identify is to name a thing, to ascertain its origin, nature, or characteristics.

and/or

Avoid this expression. State your meaning exactly.

Change: Submit X and/or Y with your application, as appropriate.

To: Submit X or Y or both with your application, as appropriate.

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apt, liable, likely

Apt means exactly suitable, to the point, appropriate.

Liable means "legally subject to" or "responsible for" and connotes legal responsibility.

Likely means probable.

as, like

As (conjunction) means to the same degree or quantity that; it is often used to indicate a correlative.

Like (preposition) is used to mean possessing the characteristics of something or resembling closely. It is not appropriate to use like as a conjunction in formal language and especially written language.

assure, ensure, insure

Assure, ensure, and insure all mean "to make secure or certain."

Assure refers to persons, and it alone has the sense of setting a person's mind at rest.

Example: The health physicist assured the concerned public that there was no risk of exposure to radiation from the normal operation of the proposed plant.

Both ensure and insure mean "to make secure from harm." However, only insure has the connotation of guaranteeing life or property against risk and should be reserved for use only in this sense.

Example: A closely followed inspection schedule will ensure proper operation of the monitoring instruments.

balance, remainder

Balance means both "a state of equilibrium" and "the amount remaining in a bank account after balancing deposits and withdrawals."

Remainder always means "what is left over." Use remainder to mean "what is left over" outside of bookkeeping contexts.

because, since

Because is the strongest and most specific connective used to state a causal relationship.

Example: He was kept under observation because his dosimeter indicated exposure to radiation.

Since is a weak substitute for because when expressing cause. It is, however, the appropriate connective when the emphasis is on circumstances or conditions rather than on cause and effect.

Example: Since all of the inspections proved the plant to be operable, the proposed startup schedule was approved.

compose, comprise, consist, include

Compose means "to create" or "to make up the whole" of something.  
Parts compose (make up) a whole.

Example: Cement, aggregate, and water (the parts) compose concrete (the whole).  
Concrete is composed of cement, aggregate, and water.

Comprise means "to embrace" or "to include." The whole comprises the parts.

Example: A botanical garden (the whole) comprises trees, flowers, and other plant life (the parts).

Consist means that all parts making up a whole are listed, but include does not.

Examples: Concrete consists of cement, aggregate, and water.  
Concrete includes cement and aggregate.

conclude, decide, determine

To conclude is to decide or judge after careful consideration.

To decide is to make up one's mind, as after doubt or debate.

To determine is to establish or ascertain definitely.

continual, continuous

Continual means intermittent or repeated at intervals.

Continuous means without interruption in time, or of unbroken extent in space.

data

Although data is sometimes used as a singular noun, the plural construction is the more appropriate in technical reports. Used as a plural, data must be referred to by plural pronouns and modifiers: those, many, few.

Do not use data generically when a more specific term, such as compilation, list of values, physical dimensions, experimental observations, or numerical results would be more precise.

The singular form of data, datum, is seldom used except in surveyor's terms like datum line and datum plane.

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definite, definitive

Definite means unmistakable, precise, or having certain limits.

Definitive refers to something complete or authoritative.

due to, because of

Due to in the sense of "caused by" is acceptable in phrases following a verb form of "to be."

Example: His fall was due to carelessness.

Due to is not acceptable when it follows other verbs and is used to mean "because of."

Change: He fell due to carelessness.

To: He fell because of carelessness.

etc.

A series introduced by the words "includes" or "such as" should not be followed by etc. because the phrases, taken together, are redundant. (Etc., when used in text, is followed by a comma except when it ends a sentence.)

factor

Factor has a precise mathematical meaning. Do not use it unnecessarily even in mathematical contexts, however. The expression "to increase by a factor of 3" means simply to triple--use triple.

farther, further

Farther refers to distance.

Further indicates additional degree, time, or quantity.

Example: As you go farther away, your ability to hear is further decreased.

fewer, less

Fewer refers to units or individuals.

Less refers to mass or bulk.

Example: With the use of less powder, fewer particles result.

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### foreword, forward, preface

Forward is very often confused with the word foreword. Even though forward describes a position of something located toward the front, it is not the correct word to describe introductory material in a report. The term foreword usually applies to a statement about a book or report written by someone other than the author. A preface is usually a statement by the author that describes the purpose, background, or scope of a book or report. (See the preface of this guide for an example.) The terms foreword and preface are often used interchangeably.

### i.e., e.g.

i.e. means "that is."

e.g. means "for example."

Note: Their English equivalents are preferable to avoid misuse, overuse, and pompousness.

### impact, impacted

Impact used as a noun means the actual striking of one body against another, or the impression of one thing on another.

Impact used as a verb means to cause to strike forcefully.

Impacted is an adjective that is often misused when the word impact should apply.

### imply, infer

Imply indicates by association or consequence rather than by direct statement.

Example: The neatness of the report implies that the typist is proud of her work.

Infer derives a conclusion from facts or premises.

Example: We infer that the hyphenation is correct.

### interpolate, extrapolate

You interpolate (meaning estimate) between two known values.

You extrapolate (meaning infer or predict) from the values of a known series.

### mutual, common

Mutual refers to two persons or things, and means reciprocally exchanged.

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Common means shared by all.

on the order of

Do not use on the order of to mean about or approximately. If you mean "within an order of magnitude," say so.

only

Place only immediately before the word or phrase it modifies. Note the difference in meaning caused by the word's location in the following sentences:

Examples: He was the only engineer.

He was only the engineer.

opposed to, compared to

Do not use opposed to unless you mean in literal opposition; use compared to instead.

Examples: Force a is opposed to force b, and is stronger.

Force a compared to force b is several times greater.

order of magnitude

Use this phrase to express measurements in powers of 10 only, not to mean "approximately."

Example: The earth's mass is about  $10^{24}$  kg; that of the sun,  $10^{30}$  kg. Their masses differ by about six orders of magnitude.

parameter, property

A parameter is an arbitrary constant or an independent variable through functions of which other functions may be expressed.

Examples: The parameters for the first test were 6 to 12 V.

Four parameters, three in space and one in time, are needed to specify an event.

A property is an explicit value or characteristic.

Example: One of the most important properties of iodine is its low temperature of sublimation.

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practical, practicable

Practical means useful in actual practice.

Practicable means capable of being put into practice.

presently, currently

Presently means in a short time, soon, directly. It does not mean now or at this time. To denote now, use currently.

principal, principle

As a noun, principal means head or chief; as an adjective, it means highest or best.

Principle means basic truth, law, or assumption.

prior, before

Prior is an adjective meaning earlier in time or order.

Before as an adverb means in advance; as a preposition it means in front of or preceding.

Example: He was hired according to prior agreement, an agreement reached before his arrival.

procure

Procure is an overworked word. We prefer buy, get, or purchase.

proved, proven

Proved is preferred as the past participle of the verb to prove.

Example: He has proved his point.

Proven is better used as an adjective.

Example: He has a proven record of achievement.

providing, provided, if

Do not use providing in the place of provided or if.

Example: Providing jobs is difficult now, but will be easier provided (if) next year's budget is adequate.

that, which

That is appropriate to restrictive (defining) clauses that are not set off by commas.

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Example: These frequencies, which increase exponentially with voltage, can cause perturbations that are self-propagating.

Which is appropriate to nonrestrictive (nondefining) clauses that are always set off by commas.

### via

Via is Latin for "by way of." Restrict its use to routing instructions.

Example: The package was sent to Bethesda via Region I.

Do not use via to mean through or as the result of outside of such contexts.

### viz

Use namely or that is instead of viz when introducing examples, lists, or items.

### whether, if

Whether implies a condition of doubt.

Example: He was not sure whether security was breached.

If implies no alternative.

Example: If it does not rain, we will move the equipment.

### while, although, whereas

The noun while, when used in adverbial phrases, indicates a period of time (during, or at the same time as). When used as a conjunction, while means "as long as" in reference to time. While should not be used in the place of although, whereas, and or but.

Although (conjunction) means regardless of the fact that or even though.

Whereas (conjunction) means in view of the fact that and is commonly used to indicate a comparison or contradiction.

### 7.2.1 Deadwood

The following unwieldy or repetitious word groups should be avoided.

#### Deadwood Expression

as far as our own observations  
are concerned, they show  
ascertain the location of

#### Clearer Substitute

we observed  
find

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### Deadwood Expression

at that point in time  
at the present time  
at this point in time  
be deficient in  
close proximity  
come to a conclusion  
consensus of opinion  
concerning this matter, it  
    may be asserted that  
conducted irradiation  
    experiments on  
due to the fact that  
during the time that  
elongate in length  
equally as well  
fewer in number  
for the purpose of  
for the reason that  
give indication of  
happen to be  
if conditions are such that  
in a manner similar to  
initial prototype (model)  
in the direction of  
in the vicinity of  
in view of the fact that  
is in a position to  
it is our opinion that  
it is possible that  
it was discovered  
it would thus appear that  
lenticular in character  
necessitates the inclusion of  
notwithstanding the fact that  
null and void  
of such hardness that  
present in greater abundance  
red in color  
round in shape  
rules and regulations  
  
serves the function of being  
subsequent to  
the question as to  
there can be little doubt that  
two equal halves  
utilize or utilization  
with reference to  
with the exception that

### Clearer Substitute

then  
now  
now  
lack  
close (or proximate)  
concluded  
consensus  
  
we assert  
  
irradiated  
because  
while  
elongate  
as well, equally well  
fewer  
for  
because  
show, indicate  
are  
if  
like  
prototype  
toward  
near  
because  
can  
we think  
perhaps  
I (we) discovered  
apparently  
lenticular  
needs, requires  
although  
null, void (use one, not both)  
so hard that  
more abundant  
red  
round  
rules, regulations (use one,  
    not both)  
is/functions as  
after  
whether  
probably  
halves  
use  
about  
except that

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### 7.3 Sex-Neutral Language in NRC Publications

A Presidential Memorandum (August 1977) and numerous Federal guidelines urge the cooperation of all Federal agencies in eliminating gender-specific terminology from regulations, policy and program statements, correspondence, reports, and all other pertinent materials. These guidelines, in essence, ask that gender-specific references be avoided unless they are necessary.

The use of precise language will eliminate most gender-specific terms. References to him or his can be eliminated by referring instead to a "licensee," "applicant," "operator," "administrator," etc. Detailed guidance on the use of sex-neutral language is provided in the following publications, which are available at NRC's Technical Library.

Office of the Federal Register. "Legal Drafting Style Manual."  
(Interim Ed.) March 1978.

U.S. Commission on Civil Rights. "Sex Bias in the U.S. Code." April 1977.

U.S. Department of Labor. "Job Title Revisions to Eliminate Sex and Age Referent Language from the Directory of Occupational Titles."  
3rd ed. 1975.

### 8. BIBLIOGRAPHY

U.S. Government Printing Office. Style Manual. Washington, DC: U.S. Government Printing Office, January 1973. Available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Webster's Third New International Dictionary of the English Language, Unabridged. Springfield, MA: G&C Merriam Co, 1971. Available from public and technical libraries.

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## APPENDIX F

### TECHNICAL WRITING BOOKS AVAILABLE FROM NRC'S TECHNICAL LIBRARY

NRC's Technical Library maintains a collection of technical writing books for staff use. Consult them for further information on specific writing topics. This appendix lists the books currently available.

The American Institute of Biological Sciences. Conference of Biological Editors Style Manual. Washington, DC: American Institute of Biological Sciences, 1972.

The American Institute of Physics. The American Institute of Physics Style Manual for Guidance in the Preparation of Papers for Journals. New York: The American Institute of Physics, 1973.

Barass, R. Scientists Must Write. London: Chapman and Hall Ltd., 1978.

Brusaw, C. T., and G. J. Alred. Practical Writing: Composition for the Business and Technical World. Boston: Allyn and Bacon, Inc., 1973.

Brusaw, C. T., G. J. Alred, and W. E. Oliu. Handbook of Technical Writing. New York: St. Martin's Press, 1976.

Gilman, W. The Language of Science: A Guide to Effective Writing. New York: Harcourt, Brace and World, Inc., 1961.

Hicks, T. G. Writing for Engineering and Science. New York: McGraw-Hill Book Co., 1961.

Houp, K. W., and T. E. Pearsall. Reporting Technical Information. Beverly Hills, CA: Glencoe Press, 1968.

Jordan, S., ed. Handbook of Technical Writing Practices, 2 vols. New York: John Wiley and Sons, Inc., 1971.

Leggett, G., C. D. Mead and W. Charvatt. Handbook for Writers. 6th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1974.

Morris, J. E. Principles of Scientific and Technical Writing. New York: McGraw-Hill Book Co., 1966.

Peterson, M. S. Scientific Thinking and Scientific Writing. New York: Reinhold Publishing Corporation, 1961.

Souther, J., and M. L. White. Technical Report Writing. 2nd ed. New York: John Wiley and Sons, Inc., 1977.

Turabian, K. A Manual for Writers of Term Papers, Theses and Dissertations. 4th ed. Chicago: University of Chicago Press, 1973.

Wirkus, T. E. Communication and the Technical Man. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1972.

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## GLOSSARY

Contractor Document: A document prepared in accordance with the provisions of a contract or under or pursuant to an interagency agreement.

Formal Contractor Reports: Regulatory and technical documents that record the results of contractor or interagency agreement work at principal points in the program. Such documents may include, but are not limited to, quarterly and annual progress reports and final reports. Prior to publication, these documents shall have received the reviews and approvals required by NRC. Such reviews and approvals shall include, but not necessarily be limited to, patent review (if applicable) and security review (if applicable). These reports will carry NUREG designations as the prime identification.

Formal Staff Reports: Regulatory and technical documents prepared in support of regulatory investigations that become publicly available records.

Interim Contractor Documents: Regulatory and technical documents prepared in accordance with contract or interagency agreement requirements for recording plans and results during the course of the work. Such documents may include, but are not limited to, informal progress reports, quick-look reports, data reports, status summary reports, project descriptions, pre-test predictions, model verifications, experiment safety analyses, experiment operating procedures, facility certification reports, and test result reports.

Level of Confidence: Degree of certainty; for example, confidence level as used in statistics.

NRC Program Project Sponsor: The NRC individual responsible for the performance of a consultant or a contractor and his subcontractor or work performed under or pursuant to an interagency agreement.

Patent Review: Review by legal staff to assure protection rights in inventions.

Publicly Available: Available to the general public in the NRC Public Document Room (PDR) for inspection and copying for a fee or ordinarily available from a public library.

Regulatory and Technical Documents: Documents that have been prepared in support of regulatory investigations and are to become publicly available records. Such documents shall carry unique identification.

Unique Identification: NRC identification used on a document and its attachments, revisions, and supplements that is not used on any other document.

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## INDEX

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