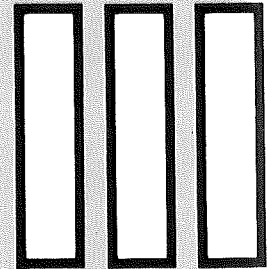


ENGINEERING SOCIETIES LIBRARY

JUN 15 1983

LIBRARY.



1983

ASME

Boiler And
Pressure Vessel
Code



An American National Standard

Nuclear
Power Plant
Components

Divisions 1

Subsection

General
Requirements

A34.2-30



ASME BOILER AND PRESSURE VESSEL CODE
AN AMERICAN NATIONAL STANDARD

(ACI STANDARD 359-83)

SECTION III

Rules for Construction of
Nuclear Power Plant Components

SUBSECTION NCA

General Requirements for
Division 1 and Division 2

1983 EDITION

JULY 1, 1983



ASME BOILER AND PRESSURE VESSEL COMMITTEE
SUBCOMMITTEE ON NUCLEAR POWER
ACI-ASME JOINT TECHNICAL COMMITTEE

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
United Engineering Center 345 East 47th Street New York, N.Y. 10017

ACC

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Consensus Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment which provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable Letters Patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

The footnotes in this document are part of this American National Standard.

Copyright © 1983 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All Rights Reserved

Date of Issue — July 1, 1983
(Includes all Addenda dated December 1982 and earlier)

No part of this document may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Library of Congress Catalog Card Number: 56-3934
Printed in the United States of America

Adopted by the Council of The American Society of Mechanical Engineers, 1914.
Revised 1940, 1941, 1943, 1946, 1949, 1952, 1953, 1956, 1959, 1962, 1965, 1968, 1971, 1974, 1977, 1980, 1983

1983 ASME BOILER AND PRESSURE VESSEL CODE

An American National Standard

SECTIONS*

- I Power Boilers
- II Material Specifications
 - Part A — Ferrous Materials
 - Part B — Nonferrous Materials
 - Part C — Welding Rods, Electrodes and Filler Metals
- III Subsection NCA — General Requirements for Division 1 and Division 2
- III Division 1
 - Subsection NB — Class 1 Components
 - Subsection NC — Class 2 Components
 - Subsection ND — Class 3 Components
 - Subsection NE — Class MC Components
 - Subsection NF — Component Supports
 - Subsection NG — Core Support Structures
 - Appendices
- III Division 2 — Code for Concrete Reactor Vessels and Containments
- IV Heating Boilers
- V Nondestructive Examination
- VI Recommended Rules for Care and Operation of Heating Boilers
- VII Recommended Rules for Care of Power Boilers
- VIII Pressure Vessels
 - Division 1
 - Division 2 — Alternative Rules
- IX Welding and Brazing Qualifications
- X Fiberglass-Reinforced Plastic Pressure Vessels
- XI Rules for Inservice Inspection of Nuclear Power Plant Components

*All Sections, except Section II, Parts A, B, and C, available in a separate SI Edition on October 1, 1983.

ADDENDA

Colored-sheet Addenda, which include additions and revisions to individual Sections of the Code, are published twice a year and will be sent automatically to purchasers of the applicable Sections up to the publication of the 1986 Code. Both Editions of the 1983 Code are available only in the loose-leaf format; accordingly, the Addenda will be issued only in the loose-leaf, replacement-page format.

Interpretations

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code. With the 1983 Edition, the Interpretations for each individual Section will be published separately and will be included with the Addenda service to that Section. Interpretations of Section III, Divisions 1 and 2, will be included with the Addenda service to Subsection NCA. Interpretations are not part of the Addenda to the Code.

CODE CASES

The Boiler and Pressure Vessel Committee meets regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases which have been adopted appear in one or both of the 1983 Code Cases books: (1) Boilers and Pressure Vessels and (2) Nuclear Components. Supplements will be sent automatically to the purchasers of one or both the Code Cases books up to the publication of the 1986 Edition. The Code Cases books are not available in a separate SI Edition.

FOREWORD

The American Society of Mechanical Engineers set up a committee in 1911 for the purpose of formulating standard rules for the construction of steam boilers and other pressure vessels. This committee is now called the Boiler and Pressure Vessel Committee.

The Committee's function is to establish rules of safety governing the design, fabrication, and inspection during construction of boilers and pressure vessels, and to interpret these rules when questions arise regarding their intent. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property and to provide a margin for deterioration in service so as to give a reasonably long safe period of usefulness. Advancements in design and material and the evidence of experience have been recognized.

The Boiler and Pressure Vessel Committee deals with the care and inspection of boilers and pressure vessels in service only to the extent of providing suggested rules of good practice as an aid to owners and their inspectors.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Boiler and Pressure Vessel Committee meets regularly to consider requests for interpretations and revisions of the rules, and to develop new rules as dictated by technological development. Inquiries must be addressed to the Secretary in writing and must give full particulars in order to receive consideration and a written interpretation. Proposed revisions to the Code resulting from inquiries will be presented to the Main Committee for appropriate action. The action of the Main Committee becomes effective only after confirmation by letter ballot of the Committee and approval by the Council of the Society.

Proposed revisions to the Code approved by the Committee are submitted to the American National

Standards Institute and published in *Mechanical Engineering* to invite comments from all interested persons. After the allotted time for public review and final approval by ASME Council, revisions are published semiannually in Addenda to the Code.

Code Cases may be used in the construction of components to be stamped with the ASME Code symbol beginning with the date of their approval by the ASME Council.

Code Editions may be used on or after the date of issue shown in the Edition. After Code revisions are approved by Council they may be used beginning with the date of issue shown on the Addenda.

Owners of nuclear power plants are cautioned that Code Editions, Addenda, and Cases to be used in construction shall be acceptable to the regulatory and enforcement authorities having jurisdiction at the nuclear power plant site.

Each state and municipality in the United States and each province in the Dominion of Canada that adopts or accepts one or more Sections of the Boiler and Pressure Vessel Code is invited to appoint a representative to act on the Conference Committee to the Boiler and Pressure Vessel Committee. Since the members of the Conference Committee are in active contact with the administration and enforcement of the rules, the requirements for inspection in this Code correspond with those in effect in their respective jurisdictions. The required qualifications for an Authorized Inspector or an Authorized Nuclear Inspector under these rules may be obtained from the administrative authority of any state, municipality, or province which has adopted these rules.

The Boiler and Pressure Vessel Committee in the formulation of its rules and in the establishment of maximum design and operating pressures considers materials, construction, method of fabrication, inspection, and safety devices. Permission may be granted to regulatory bodies and organizations publishing safety standards to use a complete Section of the Code by reference. If usage of a Section, such as Section IX, involves exceptions, omissions, or changes in provisions, the intent of the Code might not be attained.

Where a state or other regulatory body, in the printing of any Section of the Boiler and Pressure Vessel Code, makes additions or omissions, it is recommended that such changes be clearly indicated.

The National Board of Boiler and Pressure Vessel Inspectors is composed of chief inspectors of states and municipalities in the United States and of provinces in the Dominion of Canada that have adopted the Boiler and Pressure Vessel Code. This Board, since its organization in 1919, has functioned to uniformly administer and enforce the rules of the Boiler and Pressure Vessel Code. The cooperation of that organization with the Boiler and Pressure Vessel Committee has been extremely helpful.

It should be pointed out that the state or municipality where the Boiler and Pressure Vessel Code has been made effective has definite jurisdiction over any particular installation. Inquiries dealing with problems of local character should be directed to the proper authority of such state or municipality. Such authority may, if there is any question or doubt as to the proper interpretation, refer the question to the Boiler and Pressure Vessel Committee.

The Specifications for materials given in Section II, Parts A and B, are identical with or similar to those of The American Society for Testing and Materials. The Specifications for welding materials given in Section II, Part C, are identical with or similar to those of the American Welding Society. Use of the materials described in these Specifications is covered by the rules in this Section of the Boiler and Pressure Vessel Code. All materials allowed by this Section and used for construction within the scope of these rules shall be furnished in accordance with the Material Specifications contained in Section II except where otherwise provided in Code Cases or in this Section of the Code. Material produced to an ASME or ASTM Material Specification is not limited as to country of origin.

When required by context in this Section, the singular shall be interpreted as the plural, and vice-versa; and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

STATEMENT OF POLICY ON THE USE OF CODE SYMBOLS AND CODE AUTHORIZATION IN ADVERTISING

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use Code Symbols for marking items or constructions which have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the Code Symbols for the benefit of the users, the enforcement jurisdictions, and the holders of the symbols who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the symbols, Certificates of Authorization, and reference to Code construction. The Ameri-

can Society of Mechanical Engineers does not "approve," "certify," "rate," or "endorse" any item, construction, or activity and there shall be no statements or implications which might so indicate. An organization holding a Code Symbol and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities "are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code," or "meet the requirements of the ASME Boiler and Pressure Vessel Code."

The ASME Symbol shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of a Code Symbol who may also use the facsimile in advertising to show that clearly specified items will carry the symbol. General usage is permitted only when all of a manufacturer's items are constructed under the Rules.

STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the official Code Symbol Stamp described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the various Code Symbols shall not be used on any item which is

not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME which tend to imply that all Code requirements have been met when in fact they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

PERSONNEL

ASME Boiler and Pressure Vessel Committee Subcommittees, Subgroups, and Working Groups

As of July 1, 1982

MAIN COMMITTEE

W. L. Harding, <i>Chairman</i>	S. F. Harrison
E. L. Kemmler, <i>Vice Chairman</i>	E. J. Hemzy
G. M. Eisenberg, <i>Secretary</i>	M. H. Jawad
B. W. Bace	G. G. Karcher
R. D. Bonner	E. C. Kistner
R. J. Bosnak	J. LeCoff
M. N. Bressler	J. R. Mackay
V. W. Butler	W. R. Mikesell
R. J. Cepluch	F. N. Moschini
L. J. Chockie	C. C. Neely
J. T. Crosby	T. E. Northup
H. F. Dobel	W. O. Parker
W. Doty	R. F. Reedy
R. M. Gibson	W. R. Smith, Sr.
R. C. Griffin	W. E. Somers

EXECUTIVE COMMITTEE

E. L. Kemmler, <i>Chairman</i>	R. C. Griffin
W. L. Harding, <i>Vice Chairman</i>	S. F. Harrison
G. M. Eisenberg, <i>Secretary</i>	E. J. Hemzy
R. J. Cepluch	R. F. Reedy
L. J. Chockie	W. E. Somers

HONORARY MEMBERS

J. D. Andrew, Jr.	J. E. Lattan
P. M. Brister	J. L. Menson
H. M. Canavan	R. F. Miller
J. S. Clarke	C. E. Rawlins
W. E. Cooper	D. B. Westrom
W. B. Hoyt	F. S. G. Williams
J. W. James	E. J. Wiseman
E. M. Kloeblen	L. P. Zick, Jr.

MARINE CONFERENCE GROUP

J. Tiratto, <i>Chairman</i>	J. C. Maxham
V. W. Bugg	E. C. Smith

CONFERENCE COMMITTEE

J. T. Crosby—Arkansas (<i>Chairman</i>)	P. T. Jones—Rhode Island
B. L. Whitley—North Carolina (<i>Vice Chairman</i>)	G. M. Kuetemeyer— Milwaukee
S. F. Harrison—National Board (<i>Secretary</i>)	W. W. Larsen—Iowa
H. Baron—Minnesota	C. C. Mann—New Orleans
S. Bartholomew—Nevada	W. C. Mason—Mississippi
R. K. Blosch—Utah	S. Matthews—Texas
C. A. Brown—Kentucky	H. S. Mauk—Delaware
W. E. Brown—Kansas	J. P. Mickels—Nebraska
R. D. Cather—Alaska	S. J. Mierzwa—Michigan
E. B. Cimino—Colorado	D. M. Milan—Ohio
J. E. Claar—Pennsylvania	W. A. Millerwest—Prince Edward Island, Canada
A. J. Cmeyla—Chicago	J. W. Morvant—Louisiana
B. W. Cole—British Columbia, Canada	R. D. O'Connor—Connecticut
R. V. Curry—Saskatchewan, Canada	L. A. O'Morrow—Manitoba, Canada
A. W. Diamond—New Found- land and Labrador, Canada	N. C. Perron—Arizona
F. Dolen—New Jersey	D. Ross—New Brunswick, Canada
V. E. Doss—Virginia	R. Sauve—Quebec, Canada
J. J. Duffy—Wisconsin	S. Schugar—Detroit
R. Ehli—North Dakota	C. A. Sjolund—Los Angeles
H. L. Farwell—Hawaii	J. L. Smith—Alberta, Canada
D. R. Gallup—Illinois	M. L. Snow—Tennessee
J. A. Glen—California	R. P. Sullivan—Maine
J. T. Grail—Maryland	S. B. Voris—Seattle
J. W. Greenawalt—Oklahoma	C. H. Walters—Oregon
E. M. Hicks—New York	H. J. Wright—Ontario, Canada
R. R. Johnson—Indiana	R. A. Yeo—Nova Scotia, Canada

SUBCOMMITTEE ON POWER BOILERS (SC I)

W. E. Somers, <i>Chairman</i>	R. Leone
J. R. Mackay, <i>Vice Chairman</i>	R. F. Manning
M. E. Sheehan, <i>Secretary</i>	D. J. McDonald
M. D. Bernstein	R. J. Presnak
R. K. Blosch	R. Sanchez P.
J. Bruck	R. D. Schueler, Jr.
D. A. Canonico	A. T. Slatt
A. R. Faulkner	M. J. Telesmanic
D. N. French	R. L. Williams
O. F. Hedden	C. G. Winters
W. T. Higgenbotham	L. W. Yoder
E. C. Kistner	J. Aguilar (Alternate)
D. E. Lemon	

Subgroup on Care of Power Boilers (SC I)

E. C. Kistner, <i>Chairman</i>	D. J. McDonald
C. Berg	J. W. McNees
J. Brock	A. Plauchu
H. F. Dobel	G. J. Raftis
C. R. Hoefs	R. Sanchez P.
E. A. Holden	A. T. Slatt
L. J. Kuhlman	J. E. Stevens
J. A. Lux	

Subgroup on Piping (SC I)

A. T. Slatt, <i>Chairman</i>	W. L. Lowry, Jr.
C. G. Winters, <i>Secretary</i>	T. C. McGough
M. D. Bernstein	W. A. Molvie
A. J. Breugelmanns	L. J. Sas
C. A. Brown	J. A. Werhane
A. R. Faulkner	R. L. Williams
E. C. Kistner	L. W. Yoder

Subgroup on Fire Tube Boilers (SC I)

M. J. Telesmanic, <i>Chairman</i>	L. J. Kuhlman
R. K. Blosch	R. F. Manning
G. L. Kasparian	L. Sanchez G.

Subgroup on Electric Boilers (SC I)

J. R. Mackay, <i>Chairman</i>	R. F. Manning
C. A. Brown	T. H. Milton
M. A. Farrugia	R. G. Reid
R. Leone	

Subgroup on Design (SC I)

R. D. Schueler, Jr., <i>Chairman</i>	W. R. Hankins
C. G. Winters, <i>Secretary</i>	D. E. Lemon
R. K. Blosch	R. F. Manning

Subgroup on Materials (SC I)

R. F. Manning, <i>Chairman</i>	A. R. Faulkner
D. A. Canonico	L. W. Yoder

Subgroup on General Requirements (SC I)

M. D. Bernstein, <i>Chairman</i>	D. J. McDonald
F. R. Gerety	T. C. McGough
O. F. Hedden	R. Sanchez P.
R. Leone	R. L. Williams
W. L. Lowry, Jr.	L. W. Yoder

Subgroup on Fabrication and Examination (SC I)

O. F. Hedden, <i>Chairman</i>	W. T. Higgenbotham
S. G. Bankar	R. D. Schueler, Jr.
D. N. French	J. A. Werhane

SUBCOMMITTEE ON MATERIAL SPECIFICATIONS (SC II)

V. W. Butler, <i>Chairman</i>	R. A. Moen
W. C. Banks, <i>Vice Chairman</i>	E. G. Nisbett
J. Manaskie, <i>Secretary</i>	G. J. Roe
R. M. Brown	R. W. Swayne
R. Dirscherl	W. R. Sylvester
M. Gold	J. W. Tackett
G. C. Hsu	E. O. Woolridge
E. I. Landerman	A. W. Zeuthen
A. S. Melilli	

Subgroup on Steel Plates (SC II)

A. W. Zeuthen, <i>Chairman</i>	R. E. Lorentz, Jr.
R. M. Brown	J. W. McGrew
D. D. Carpenter	A. S. Melilli
W. D. Edsall	G. J. Roe
H. W. Garvin	E. O. Woolridge
J. F. Longenecker	

Subgroup on Steel Tubular Products (SC II)

W. R. Sylvester, <i>Chairman</i>	R. P. Stripay
R. P. Meineke	R. H. Zong
E. J. Rozic, Jr.	

Subgroup on Steel Castings, Forgings, and Boltings (SC II)

E. G. Nisbett, <i>Chairman</i>	A. S. Melilli
W. C. Banks	D. R. Moyer
R. F. Cappellini	J. S. Orlando
B. M. Dingman	C. J. Parmentier
A. F. Gross	D. A. Patience
J. A. Kozub	H. C. Templeton
E. I. Landerman	E. O. Woolridge

Subgroup on Nonferrous Alloys (SC II)

R. Dirscherl, <i>Chairman</i>	G. C. Hsu
J. W. Tackett, <i>Secretary</i>	G. Knapp
R. A. Clemons	R. T. Webster
A. Cohen	M. J. Weiss

SUBCOMMITTEE ON NUCLEAR POWER (SC III)

R. F. Reedy, *Chairman*
 W. R. Smith, Sr., *Vice Chairman*
 J. Millman, *Secretary*
 J. N. Baysden
 R. J. Bosnak
 E. B. Branch
 M. N. Bressler
 F. W. Catudal
 L. J. Chockie
 J. B. Christofferson
 R. L. Dick
 P. M. Dimitroff
 H. F. Dobel
 W. Doty
 F. R. Drahos

J. J. Duffy
 E. F. Gerwin
 E. J. Hemzy
 R. E. Jagger
 W. G. Knecht
 D. F. Landers
 W. N. McLean
 F. N. Moschini
 T. E. Northup
 C. M. Purdy
 E. C. Rodabaugh
 D. W. Sher
 S. W. Tagart, Jr.
 J. E. Vessely

**Working Group on Duties and Responsibilities
(SG-GR) (SC III & 3C)**

W. Schultheis, *Co-Chairman*
 R. Shanlever, *Co-Chairman*
 W. L. Lowry, Jr., *Secretary*
 J. E. Ayotte
 J. N. Baysden
 E. P. Burke
 J. E. Crowe
 J. J. Duffy
 A. C. Eberhardt
 T. E. Hansen
 P. J. Herbert

W. F. Johnson
 B. C. Larcher
 A. S. Laursen
 R. S. Love
 J. R. Luke
 B. D. Rall
 R. T. Rose
 D. W. Sher
 J. E. Triolo
 R. E. Weber
 D. R. Young

**Special Working Group on Containment Systems for
Nuclear Spent Fuel and High Level Waste
Transport Packagings (SC III)**

K. Goldmann, *Chairman*
 W. H. Brinkman
 D. A. Canonico
 R. J. Claverie
 R. M. Jefferson
 C. R. Johnson
 R. H. Jones

C. E. MacDonald
 J. J. McLellan
 F. N. Moschini
 R. E. Nickell
 W. H. Rogers
 R. Sanacore
 C. J. Temus

**Working Group on Data Report Forms
(SG-GR) (SC III & 3C)**

R. E. Muise, *Chairman*
 C. W. Allison
 R. C. Arthurs
 J. N. Babcock, Jr.
 C. F. Buckley

B. W. Burak
 F. Norman
 R. Siever
 M. F. Sullivan

Subgroup on General Requirements (SC III & 3C)

F. W. Brady, *Co-Chairman*
 H. F. Dobel, *Co-Chairman*
 J. R. Barbee
 J. N. Baysden
 R. J. Bosnak
 F. W. Catudal
 J. J. Duffy
 E. F. Gerwin

W. S. Gibbons, Jr.
 R. D. Kulchak
 M. J. Meyer
 F. N. Moschini
 R. E. Muise
 W. Schultheis
 R. Shanlever
 G. M. Tolson

Subgroup on Materials (SC III)

W. G. Knecht, *Chairman*
 W. H. Borter
 M. N. Bressler
 B. G. Carlton
 F. R. Drahos
 F. P. Fetterolf
 W. D. Goins
 D. R. Haines
 J. W. Juppenlatz, Jr.
 E. I. Landerman
 W. H. Leach
 J. F. Longenecker
 N. J. Mares

R. D. McKellar
 W. N. McLean
 R. P. Meineke
 R. H. Moeller
 C. J. Parmentier
 L. M. Petrick
 W. J. Sperko
 R. W. Swayne
 A. Taboada
 S. E. Tyson
 M. Weiss
 H. Yoon
 D. E. Young

Working Group on Quality Assurance (SG-GR) (SC III & 3C)

W. S. Gibbons, Jr.,
Co-Chairman
 R. D. Kulchak, *Co-Chairman*
 R. C. Arthurs
 J. N. Babcock, Jr.
 J. R. Barbee
 J. V. Bosco
 A. Breed
 R. B. Bremmer
 B. W. Burak

R. Davis
 J. D. Lenardson
 H. A. Manning
 J. McLaughlin
 M. J. Meyer
 R. E. Muise
 T. G. Scarbrough
 S. N. Sparacino
 G. M. Tolson
 R. B. Yori

Subgroup on Design (SC III)

D. F. Landers, *Chairman*
 E. B. Branch
 M. N. Bressler
 W. G. Brussalis
 N. W. Edwards
 W. F. English, Jr.
 F. P. Hill, Jr.
 E. M. Livingston
 W. N. McLean

R. W. Mikitka
 C. A. Moore
 C. M. Purdy
 E. C. Rodabaugh
 B. L. Silverblatt
 J. D. Stevenson
 J. H. Wawrzyniak
 W. M. Wepfer
 K. R. Wichman

Special Working Group on Dynamic Analysis (SG-D) (SC III)

R. Wray, <i>Chairman</i>	R. P. Kassawara
R. D. Blevins	L. K. Liu
G. F. Bohm	A. E. Meligi
A. P. Cobb, Jr.	T. M. Mulcahy
N. A. Goldstein	J. D. Stevenson
A. H. Hadjian	S. W. Tagart, Jr.

Special Working Group on Faulted Conditions (SG-D) (SC III)

G. F. Bohm, <i>Chairman</i>	M. T. Lau
P. L. Anderson	D. P. Munson
C. W. Bruny	P. R. Olson
G. Bushell	P. P. Raju
W. F. English, Jr.	H. K. Shaw
J. Ferdous	W. A. Von Rieseaman
M. Hartzman	

Working Group on Vessels (SG-D) (SC III)

C. A. Moore, <i>Chairman</i>	R. W. Mikitka
R. Broman	P. P. Raju
C. W. Bruny	P. N. Randall
D. R. Denton	R. F. Sammataro
N. W. Edwards	R. E. Tome
J. F. Finn, Jr.	J. C. Tsai
G. T. Haugland	A. Walsenko
F. P. Hill, Jr.	K. R. Wichman
A. Merend	

Working Group on Piping (SG-D) (SC III)

E. B. Branch, <i>Chairman</i>	S. E. Moore
L. E. Alsager	E. D. Mysinger
K. C. Chang	M. H. Pedell
H. W. Dolfi	R. F. Petrokas
G. W. Gartland	E. C. Rodabaugh
S. Gils	E. O. Swain
A. B. Glickstein	E. A. Wais
R. W. Haupt	A. G. Walther
R. S. Hill III	L. E. Wright
D. F. Landers	W. B. Wright
M. V. Malkmus	M. P. Zyne

Working Group on Pumps (SG-D) (SC III)

J. H. Wawrzyniak, <i>Chairman</i>	D. R. Hyatt
G. G. Anderson	A. N. MacCrum
C. S. Boster	J. C. Major
H. L. Brammer	J. R. McEwan
D. L. Cummings	P. J. Nagengast
R. Dervedde	J. J. Ranft
H. R. Graglia	W. M. Wepfer

Working Group on Valves (SG-D) (SC III)

W. N. McLean, <i>Chairman</i>	L. J. Malandra
P. H. Awtrey	J. J. McGavin
I. L. Beltz	B. J. Milleville
R. R. Brodin	H. R. Sonderegger
B. P. Brooks	J. C. Tsacoyeanes
J. M. Cowley	R. G. Visalli
R. J. Kiessel	R. T. Wolantejus
W. G. Knecht	J. R. Zahorsky
R. Koester	B. Zannini
B. H. Leonard, Jr.	B. M. Zarolia

Working Group on Component Supports (SG-D) (SC III)

M. N. Bressler, <i>Chairman</i>	E. D. Mysinger
G. M. Bove	H. Noreen, Jr.
J. T. Boyd	R. F. Petrokas
B. J. Cheek	L. J. Pierce
E. W. Corner	C. L. Ray, Jr.
R. J. Doelling	E. O. Swain
Z. A. Kravets	K. R. Wichman
R. J. Masterson	R. T. Wolantejus
A. E. Meligi	M. P. Zyne
A. J. Moellenbeck	

Working Group on Core Support Structures (SG-D) (SC III)

B. L. Silverblatt, <i>Chairman</i>	W. F. English, Jr.
T. Vetter, Jr., <i>Secretary</i>	F. T. Grubelich
R. W. Bonsall	J. F. Walker
C. W. Collins	

Working Group on FRP Pipe (SG-D) (SC III)

L. Loziuk, <i>Chairman</i>	J. Newman
R. J. Bailey	L. Porse
A. B. Glickstein	R. A. White
M. E. Greenwood	

Subgroup on Fabrication and Examination (SC III)

F. N. Moschini, <i>Chairman</i>	R. W. Jackson
H. A. Sepp, Jr., <i>Secretary</i>	R. M. Jessee
C. W. Allison	W. G. Knecht
D. C. Bertossa	J. Lang
W. H. Borter	J. R. McGuffey
W. M. Byerley	W. N. McLean
B. G. Carlton	W. A. Molvie
J. B. Christofferson	J. L. Perkins
F. R. Drahos	C. M. Purdy
G. B. Georgiev	J. W. Richardson
E. F. Gerwin	R. E. Schuessler
J. E. Harris	R. E. Tschirch
D. P. Hegglin	

Subgroup on Pressure Relief (SC III)

F. W. Catudal, <i>Chairman</i>	W. D. Greenlaw
R. A. Cedel	S. F. Harrison
F. C. Cherny	D. M. Pattarini
P. M. Dimitroff	K. R. Shaw

Subgroup on Elevated Temperature Construction (SC III)

A. W. Dalcher, <i>Chairman</i>	R. I. Jetter
J. L. McLean, <i>Secretary</i>	F. B. Litton
J. J. Duffy	R. M. Mello
W. D. Goins	R. A. Moen
R. E. Jagger	J. M. Tanzosh

JOINT ACI-ASME COMMITTEE ON CONCRETE PRESSURE COMPONENTS FOR NUCLEAR SERVICE (SC-3C)

J. P. Allen, <i>Chairman</i>	D. Morano
T. E. Northup, <i>Vice Chairman</i>	M. J. Morris
S. D. Weinman, <i>Secretary</i>	R. G. Oesterle
J. F. Artuso	F. S. Ople, Jr.
M. Bender	D. K. Peetz
R. A. Bradshaw, Jr.	R. P. Pizzuti
F. W. Brady	P. Reinhardt
T. M. Brown	F. Rinaldi
B. A. Erler	E. R. Rybarski
G. L. Fisher	M. Schupack
M. M. Forseth	B. B. Scott
A. E. Goldman	R. Shanlever
D. J. Haavik	C. P. Siess
T. E. Johnson	J. D. Stevenson
W. F. Johnson	B. K. Thornley, Jr.
R. D. Kulchak	R. N. White
D. P. Moore	

Working Group on Concrete Inspectors Qualifications (SG-GR) (SC-3C)

F. W. Joyce, <i>Chairman</i>	W. F. Johnson
J. F. Artuso	R. J. Vurpillat
H. W. Gilley	R. E. Wilson
C. E. Jaycox	

Subgroup on Materials, Constructions, and Examinations (SC-3C)

R. A. Bradshaw, Jr., <i>Chairman</i>	J. F. Hildebrand
J. P. Allen	A. W. Isberner
G. L. Fisher	D. P. Moore
M. M. Forseth	P. Reinhardt
D. J. Haavik	R. A. Rohrbacher

Working Group on Concrete (SG-M, C & E) (SC-3C)

D. J. Haavik, <i>Chairman</i>	G. R. Murphy
J. P. Allen	R. W. Narva
J. F. Best	R. P. Pizzuti
R. A. Bradshaw, Jr.	R. A. Rohrbacher
J. Gutierrez	E. R. Rybarski
A. Isberner	

Working Group on Reinforcing and Prestressing Systems (SG-M, C & E) (SC-3C)

D. P. Moore, <i>Chairman</i>	D. K. Peetz
J. E. Barry	P. Reinhardt
J. R. Leclair	B. K. Thornley, Jr.
R. B. Lipinski	G. Valentyeny
D. S. Mehta	

Working Group on Liners (SG-M, C & E) (SC-3C)

G. L. Fisher, <i>Chairman</i>	J. F. Hildebrand
R. M. Attar	J. D. Madden
U. I. Gosts	

Subgroup on Design (SC-3C)

B. B. Scott, <i>Chairman</i>	R. G. Oesterle
L. I. Cheng	F. S. Ople, Jr.
J. A. Curtin	J. A. Raulinaitis
J. F. Fulton	R. E. Shewmaker
M. J. Holley	K. O. Stalter
D. C. Jeng	J. D. Stevenson
T. E. Johnson	A. Walser
R. E. Koppe	R. N. White
R. A. Mattson	

Subgroup on Testing and Protection Against Overpressure (SC-3C)

T. M. Brown, <i>Chairman</i>	R. B. Lipinski
S. Guha-Majumdar	N. J. Tuholski
H. T. Hill	L. F. Wallace

Subgroup on Core Support Structures (SC-3C)

A. E. Goldman, <i>Chairman</i>	F. V. Fair
J. W. Borkowski	P. A. Stancampiano
T. P. Chang	T. Y. P. Tan
A. A. Cline	G. T. Yah
J. M. Day	Z. Zudans

SUBCOMMITTEE ON HEATING BOILERS (SC IV)

S. F. Harrison, <i>Chairman</i>	D. R. Gallup
M. J. Telesmanic, <i>Vice Chairman</i>	G. L. Kasparian
F. P. Barton	M. Lieblich
G. F. Carlson	Z. R. McCain, Jr.
P. G. Daugirda	T. H. Milton
R. B. Duggan	R. I. Mullican
A. N. Duncan	N. F. Vierson III
G. E. Fratcher	R. H. Weigel
	J. I. Woodworth

Subgroup on Radiography (SC V)

E. J. Wnek, <i>Chairman</i>	B. Kovacs
J. J. Callinan, Jr.	T. F. Luga
D. L. Crabtree	S. Markowitz
L. T. Detlor	T. G. McCarty
B. E. Foster	C. N. Sherlock
R. Hardison	B. K. Warren

Subgroup on Care and Operation of Heating Boilers (SC IV)

Z. R. McCain, Jr., <i>Chairman</i>	M. Lieblich
F. P. Barton	T. H. Milton
V. E. Doss	R. H. Weigel
J. Giambrore	J. I. Woodworth

Subgroup on Ultrasonics (SC V)

P. J. Herbert, <i>Chairman</i>	R. W. McClung
F. C. Berry	W. C. McGaughey
L. J. Chockie	E. E. Potter
N. O. Cross	F. J. Sattler
F. T. Duba	J. C. Spanner
V. S. Goel	F. R. A. Turner
D. A. Gomien	R. E. Vincent (Alternate)
E. T. Hughes, Jr.	

Subgroup on Water Heaters (SC IV)

G. E. Fratcher, <i>Chairman</i>	W. H. Dormer, Jr.
A. N. Duncan, <i>Secretary</i>	W. L. Garvin
F. P. Barton	G. R. Lewis
P. G. Daugirda	E. Wenczl

Subgroup on Surface NDE (MT, PT, & ET) (SC V)

H. G. Bogart, <i>Chairman</i>	H. C. Graber
A. S. Birks	R. M. Jessee
J. B. Christofferson	J. B. Morgan
J. I. Dantzer	

Subgroup on Cast Iron Boilers (SC IV)

D. R. Gallup, <i>Chairman</i>	R. H. Weigel
W. L. Garvin	J. I. Woodworth

SUBCOMMITTEE ON NONDESTRUCTIVE EXAMINATION (SC V)

J. R. Mackay, <i>Chairman</i>	P. J. Herbert
R. C. Hudson, <i>Vice Chairman</i>	E. T. Hughes, Jr.
J. Brzuszkiewicz, <i>Secretary</i>	T. F. Luga
A. S. Birks	S. Markowitz
H. G. Bogart	W. C. McGaughey
J. B. Christofferson	E. D. Potter
B. H. Clark	L. Rabago
L. T. Detlor	F. J. Sattler
W. H. Dormer, Jr.	J. C. Spanner
F. T. Duba	J. Sunukjian
H. C. Graber	E. J. Wnek
G. W. Hembree	

Special Working Group on Acoustic Emission (SC V)

D. M. Bertelsman	J. F. Manning
B. H. Clark	E. E. Potter
N. O. Cross	J. C. Spanner
T. J. Fowler	

SUBCOMMITTEE ON PRESSURE VESSELS (SC VIII)

Subgroup on General Requirements (SC V)

G. W. Hembree, <i>Chairman</i>	W. H. Dormer, Jr.
J. O. Brown	H. S. Garcha
B. H. Clark	J. Sunukjian
R. J. Claverie	

R. J. Cepluch, <i>Chairman</i>	M. H. Jawad
J. LeCoff, <i>Vice Chairman</i>	G. G. Karcher
A. J. Roby, <i>Secretary</i>	P. E. Loveday
B. W. Bace	J. C. Maxham
R. D. Bonner	W. R. Mikesell
V. W. Butler	C. C. Neely
P. Y. Chow	R. F. O'Neill
J. R. Farr	F. O. Parnkopf
H. B. France	R. J. Sinisi
G. E. Fratcher	J. J. Szigety
W. L. Garvin	C. M. Vogrin
R. M. Gibson	B. L. Whitley
R. C. Griffin	

Special Working Group on Heat Transfer Equipment (SC VIII)

G. G. Karcher, <i>Chairman</i>	A. W. Lohmeier
J. H. Kissel, <i>Vice Chairman</i>	U. R. Miller
H. A. Schmidt, Jr., <i>Secretary</i>	H. C. Rauschenplat
D. E. Bolt	A. P. Rochino
G. Borushko	J. E. Soehrens
B. J. Field	A. I. Soler
T. K. Haldas	W. A. Treff
A. M. Impagliazzo	S. Yokell

Subgroup on Design (SC VIII)

J. R. Farr, <i>Chairman</i>	G. G. Karcher
R. E. Knoblock, <i>Secretary</i>	R. W. Mikitka
R. M. Gibson	J. J. Murphy
N. Gilbert	R. F. O'Neill
R. E. Gleason	A. Selz
J. A. Hayward	D. Staskelunas
M. H. Jawad	C. M. Vogrin

Special Working Group on Composite Concrete and Steel High Pressure Vessels (SC VIII)

P. Y. Chow, <i>Chairman</i>	D. J. Naus
R. E. Bachman	F. S. Ople, Jr.
R. D. Ciatto	G. R. Sepelek
T. J. Fowler	A. M. Smolen
R. C. Griffin	J. Stringer
G. G. Karcher	S. Thoman
E. F. Linck	D. L. Wu

Working Group on Non-Circular Vessels (SG-D) (SC VIII)

A. Selz, <i>Chairman</i>	A. M. Smolen
N. Gilbert	E. L. Thomas, Jr.
H. B. Peters	J. L. Urner

Special Working Group on High Pressure Vessels (SC VIII)

W. R. Mikesell, <i>Chairman</i>	D. P. Kendall
M. E. Sheehan, <i>Secretary</i>	G. Mraz
D. J. Burns	C. C. Neely
L. R. Douglas	E. G. Nisbett
R. G. Fasiczka	H. C. Rauschenplat
R. E. Feigel	E. R. Sliwinski
D. M. Fryer	D. A. Swift
R. E. Jagger	F. W. Tatar

Subgroup on Fabrication and Inspection (SC VIII)

J. J. Szigety, <i>Chairman</i>	J. P. Houstrup
R. F. O'Neill, <i>Secretary</i>	J. Lang
W. B. Boyer	F. O. Parnkopf
J. O. Brown	R. E. Schuessler
S. C. Cyr	R. J. Sinisi
H. B. France	R. F. Wagner
M. J. Houle	

Subgroup on General Requirements (SC VIII)

R. D. Bonner, <i>Chairman</i>	C. C. Neely
S. E. Johnson, <i>Secretary</i>	A. J. Palmer
A. P. Ahrendt	A. M. Smolen
M. R. Bauman	J. E. Stevens
D. D. Carpenter	W. J. Stuber
H. F. Colter	W. E. Vogler
W. L. Garvin	B. L. Whitley
J. C. Maxham	

Working Group on Layered Vessels (SGFI) (SC VIII)

F. O. Parnkopf, <i>Chairman</i>	R. M. Gibson
A. M. Smolen, <i>Secretary</i>	N. Gilbert
E. A. Becker	J. L. Jacobowitz
S. M. Caldwell	R. E. Pechacek
L. R. Douglas	H. C. Rauschenplat
G. E. Fratcher	B. L. Whitley

Subgroup on Materials (SC VIII)

M. H. Jawad, <i>Chairman</i>	J. J. Gaughan
E. D. Narduzzi, <i>Secretary</i>	J. Hainsworth
W. C. Banks	H. L. Hime
V. W. Butler	E. G. Nisbett
D. D. Erickson	J. W. Tackett
H. W. Garvin	

SUBCOMMITTEE ON WELDING (SC IX)

R. C. Griffin, <i>Chairman</i>	G. W. Oyler
B. D. Hackney, <i>Vice Chairman</i>	D. K. Peetz
J. Brzuszkiewicz, <i>Secretary</i>	K. J. Pon
B. L. Alia	S. D. Reynolds
L. J. Christensen	R. K. Sager, Jr.
H. R. Cobb	H. S. Sayre
H. R. Conaway	W. K. Scattergood
W. Doty	N. G. Schreiner
R. L. Harris	J. L. Smith
H. L. Helmbrecht	G. K. Sosnin
H. L. Hime	W. J. Sperko
M. J. Houle	G. W. Spohn III
R. A. LaPointe	K. C. Taber
R. E. Lorentz, Jr.	R. R. Young
A. H. Miller	D. Stull (Alternate)

Subgroup on Materials (SC IX)

R. E. Lorentz, Jr., <i>Chairman</i>	R. K. Sager, Jr.
M. L. Carpenter	W. J. Sperko
H. R. Conaway	J. W. Tackett
R. M. Jessee	R. R. Young
A. S. Melilli	H. E. Zielke
A. H. Miller	

Subgroup on General Requirements (SC IX)

D. K. Peetz, <i>Chairman</i>	H. S. Sayre
R. L. Harris	N. G. Schreiner
M. J. Houle	W. J. Sperko
R. M. Jessee	G. W. Spohn III
G. W. Oyler	K. C. Taber

Subgroup on Procedure Qualification (SC IX)

M. J. Houle, <i>Chairman</i>	H. L. Helmbrecht
B. L. Alia	S. D. Reynolds
L. J. Christensen	W. J. Sperko
H. R. Cobb	E. G. Thompson

Subgroup on Performance Qualification (SC IX)

M. J. Houle, <i>Chairman</i>	W. K. Scattergood
B. D. Hackney	H. A. Sosnin
R. A. LaPointe	D. L. Tevis
J. J. Meyer	E. G. Thompson
P. P. Norris	

Subgroup on Brazing (SC IX)

B. D. Hackney, <i>Chairman</i>	A. H. Miller
M. L. Carpenter	K. J. Pon
R. A. LaPointe	D. A. J. Stegner

**SUBCOMMITTEE ON REINFORCED PLASTIC
PRESSURE VESSELS (SC X)**

J. Brzuszkiewicz, <i>Secretary</i>	R. F. Foral
E. E. Bates	S. F. Harrison
D. M. Bertelsman	J. Hassert
W. L. Bliley	W. D. Humphrey
J. W. Carter	A. B. Isham
J. J. Duffy	E. E. Morgenegg

**SUBCOMMITTEE ON NUCLEAR INSERVICE INSPECTION
(SC XI)**

L. J. Chockie, <i>Chairman</i>	W. C. Ham
W. O. Parker, <i>Vice Chairman</i>	P. J. Herbert
K. I. Baron, <i>Secretary</i>	J. P. Houstrup
C. W. Allison	L. R. Katz
W. F. Anderson	J. R. Knoke
A. J. Birkle	J. J. Lance
R. E. Bullock	R. R. Maccary
S. H. Bush	M. S. Markowicz
D. D. Davis	G. J. Pitzl
F. T. Duba	P. C. Riccardella
H. L. Gotschall	M. E. Schuster, Jr.
F. E. Gregor	C. H. Walters
L. B. Gross	F. A. Warner
G. J. Hallinan	W. P. Worden

Working Group on Concrete Pressure Components (SC XI)

H. T. Hill, <i>Chairman</i>	J. F. Fulton
H. Ashar	H. L. Gotschall
R. E. Bullock	S. Guha-Majumdar
C. A. Byrd	A. M. Salley
F. T. Duba	G. Valentyeny

Special Working Group on Editing and Review (SC XI)

R. L. Beverly, <i>Chairman</i>	M. J. Partridge
R. J. Claverie	R. F. Sammataro
L. B. Gross	R. W. Swayne
V. H. Hight	F. A. Warner
R. R. Maccary	

Subgroup on General Requirements (SC XI)

L. B. Gross, <i>Chairman</i>	J. M. Madara
R. J. Claverie, <i>Secretary</i>	C. V. Moore
C. W. Allison	M. J. Partridge
W. E. Cawley	S. M. Sullivan
G. Gotch	J. H. Uhl
F. A. Hawksley	F. A. Warner
J. R. Knoke	

Working Group on Regulatory Guides (SG-GR) (SC XI)

J. R. Knoke, <i>Chairman</i>	E. J. Parent
L. B. Gross	

**Working Group on Inspection Duties and Code Application
(SG-GR) (SC XI)**

J. H. Uhl, <i>Chairman</i>	S. M. Sullivan
R. J. Claverie, <i>Secretary</i>	C. H. Walters
L. Frank	F. A. Warner
G. Gotch	W. P. Worden

Working Group on Component Supports (SG-WCS) (SC XI)

D. D. Davis, <i>Chairman</i>	C. N. Krishnaswamy
J. T. Boyd	H. K. Shaw
R. F. Brandt	K. A. Stanley
E. D. Delp	R. J. Tamminga
F. T. Duba	M. P. Zyne
J. M. Kovacs	

**Working Group on Inspection of Class 2 Systems
(SG-GR) (SC XI)**

M. J. Partridge, <i>Chairman</i>	L. Sage
C. Brader	R. E. Scott
E. J. Brown	W. A. Sims
A. R. Carpenter	F. Tehranchi
M. T. Cross	J. H. Uhl
F. Famulari	R. C. VanLear
J. B. Martin	

Subgroup on Repairs and Replacements (SC XI)

W. C. Ham, <i>Chairman</i>	J. B. Henderson
F. T. Duba, <i>Secretary</i>	T. J. Mawson
D. C. Bertossa	L. M. McBride
J. Derrico	M. E. Schuster, Jr.
J. F. Enrietto	J. C. Tobin
W. L. Garvin	R. H. Waskey, Jr.
W. D. Goins	

Subgroup on Water-Cooled Systems (SC XI)

A. J. Birkle, <i>Chairman</i>	S. Lefkowitz
R. L. Beverly, <i>Secretary</i>	R. E. Legate
A. E. Curtis	J. B. Martin
D. D. Davis	E. J. Parent
F. J. Dodd	R. L. Powers
W. S. Hazelton	F. Tehranchi
L. R. Katz	G. Wasilenko

Working Group on Repair Welding (SG-RR) (SC XI)

W. D. Goins, <i>Chairman</i>	H. J. Kaplan
B. G. Carlton, <i>Secretary</i>	R. D. Kerr
D. C. Bertossa	R. A. LaPointe
B. R. Crowley	W. E. Mayott
S. R. Eley	J. T. Reilly
M. J. Houle	E. H. Williams

**Working Group on Nondestructive Examination
(SG-WCS) (SC XI)**

E. DeBarba, <i>Chairman</i>	M. G. Hacker
J. L. Wood, <i>Secretary</i>	P. J. Herbert
D. C. Adamonis	V. H. Hight
P. S. Barry	M. R. Hum
F. L. Becker	E. J. Parent
W. T. Clayton	B. R. Rajala
J. F. Cook	F. J. Sattler
C. D. Cowfer	A. E. Smith
F. J. Dodd	R. M. Stone
F. T. Duba	

Working Group on Replacements (SG-RR) (SC XI) (SC-P)

T. J. Mawson, <i>Chairman</i>	R. E. Legate
L. M. McBride, <i>Secretary</i>	G. J. Pitzl
M. J. Crisler	M. E. Schuster, Jr.
S. R. Eley	R. E. Tschirch
J. B. Henderson	

Subgroup on Gas-Cooled Systems (SC XI)

F. A. Warner, <i>Chairman</i>	F. E. Lesko
L. M. McBride, <i>Secretary</i>	F. B. Litton
H. L. Gotschall	R. W. Peters

**Working Group on Steam Generator Inspection
(SG-WCS) (SC XI)**

A. J. Birkle, <i>Chairman</i>	L. B. Gross
C. J. Denton	E. J. Parent
P. P. DeRosa	A. J. Spencer
L. Frank	

Subgroup on Liquid-Metal-Cooled Systems (SC XI)

M. S. Markowicz, <i>Chairman</i>	J. Matte III
H. C. Jung, <i>Secretary</i>	L. J. Nemeth
R. A. Baker	G. Seed
W. L. Chase	R. W. Spear
J. Coonan	J. C. Tobin
R. F. Green	T. J. Walker
G. J. Hallinan	

**Working Group on Liquid Metal Reactor Covers
(SGLMCS) (SC XI)**

W. L. Chase, *Chairman* G. Seed
J. Matte III G. J. Snyder
L. J. Nemeth

Subgroup on Containment (SC XI)

F. E. Gregor, *Chairman* B. M. Hinton
R. F. Sammataro, *Secretary* D. R. Pitcairn
W. J. Briggs M. Revett
R. E. Bullock J. E. Staffiera
K. S. Herring J. F. Strunk

Subgroup on Evaluation Standards (SC XI)

S. H. Bush, *Chairman* J. P. Houstrup
P. C. Riccardella, *Secretary* R. R. Maccary
W. H. Bamford T. U. Marston
C. E. Buchalet S. Ranganath
C. Y. Cheng W. A. Vandersluys
E. DeBarba S. Yukawa

Working Group on Flaw Evaluation (SG-ES) (SC XI)

W. H. Bamford, *Chairman* J. P. Houstrup
R. C. Cipolla, *Secretary* M. Kupinski
J. M. Bloom T. U. Marston
C. E. Buchalet J. G. Merkle
C. Y. Cheng S. Ranganath
T. J. Griesbach S. Yukawa

SUBCOMMITTEE ON PROPERTIES OF METALS (SC-P)

D. A. Canonico, *Chairman* W. H. Leach
J. Manaskie, *Secretary* R. H. Moeller
A. P. Ahrendt R. A. Moen
C. C. Clark E. D. Narduzzi
J. F. Copeland W. J. O'Donnell
H. T. Corten A. J. Palmer
W. Doty B. W. Roberts
A. R. Faulkner D. I. Roberts
R. F. Gill G. V. Smith
R. J. Glodowski J. W. Tackett
M. Gold

Subgroup on Strength, Ferrous Alloys (SC-P)

M. Gold, *Chairman* W. H. Leach
A. P. Ahrendt R. A. Moen
V. W. Butler E. D. Narduzzi
D. A. Canonico B. W. Roberts
J. F. Copeland J. E. Rogozenski
D. P. Edmonds G. V. Smith
R. F. Gill C. E. Spaeder
R. J. Glodowski J. Stratton
W. C. Hagel P. F. Wieser
S. O. Hilton

Subgroup on Strength, Nonferrous Alloys (SC-P)

J. W. Tackett, *Chairman* E. E. Mild
R. Dirscherl R. H. Moeller
D. G. Harman E. Shapiro
T. G. McCarty R. T. Webster

**Subgroup on Strength of Weldments (SC-P) (SC IX)
(Joint Subgroup)**

W. Doty, *Chairman* W. H. Leach
H. R. Cobb B. W. Roberts
D. P. Edmonds D. I. Roberts
G. H. Harth R. K. Sager, Jr.

Subgroup on Fatigue Strength (SC-P)

W. J. O'Donnell, *Chairman* M. Katcher
C. R. Brinkman C. W. Lawton
J. A. Hayward M. J. Manjoine
L. A. James G. C. Millman
C. E. Jaske R. R. Seely
D. P. Jones G. H. Weidenhamer

Subgroup on Toughness (SC-P)

H. T. Corten, *Chairman* R. K. Nanstad
D. J. Ayres E. G. Nisbett
R. M. Brown A. Selz
R. F. Cappelini A. K. Shoemaker
R. J. Glodowski R. D. Stout
H. A. Grubb M. F. Wheatcroft
W. S. Hazelton D. E. Young
E. I. Landerman S. Yukawa
F. J. Loss R. Zawierucha

Working Group on Non-Nuclear Application (SG-D) (SC-P)

R. M. Brown
R. J. Glodowski
E. G. Nisbett

R. D. Stout
M. F. Wheatcroft
R. Zawierucha

Working Group on Nuclear Application (SG-T) (SC-P)

E. I. Landerman, *Chairman*
R. F. Cappelini
H. A. Grubb
W. S. Hazelton

F. J. Loss
A. Selz
D. E. Young

Working Group on Toughness Criteria (SG-T) (SC-P)

H. T. Corten, *Chairman*
D. J. Ayres
R. K. Nanstad

A. K. Shoemaker
S. Yukawa

SUBCOMMITTEE ON SAFETY VALVE REQUIREMENTS (SC-SV)

S. F. Harrison, *Chairman*
W. L. Garvin, *Vice Chairman*
J. Brzuszkiewicz, *Secretary*
G. C. Batz
M. D. Bernstein
G. F. Carlson
R. A. Cedel
O. J. Cox, Jr.
E. C. Cullie
R. J. Doelling

J. T. Grail
W. D. Greenlaw
H. I. Gregg
F. J. Howes
E. C. Kistner
D. E. Lemon
Z. R. McCain, Jr.
A. J. Schmidt
S. M. Sullivan

SUBCOMMITTEE ON DESIGN (SC-D)

W. R. Mikesell, *Chairman*
S. W. Tagart, Jr., *Vice Chairman*
C. E. Nielsen, *Secretary*
O. B. Abhat
L. Conway
J. R. Farr

R. J. Glodowski
R. I. Jetter
D. F. Landers
H. W. Marsh
R. D. Schueler, Jr.
M. P. Schwartz

Subgroup on Openings (SC-D)

M. P. Schwartz, *Chairman*
H. H. Schneider, *Secretary*
F. C. Adamek
M. N. Bressler
J. R. Farr
R. E. Gleason
S. C. Lou

R. W. Mikitka
P. P. Raju
E. C. Rodabaugh
R. W. Schneider
H. K. Shaw
D. L. Shira
E. D. Ssinegurski

Subgroup on External Pressure (SC-D)

H. W. Marsh, *Chairman*
O. B. Abhat
L. Conway
C. J. Kelly

W. J. Koves
E. M. Livingston
C. D. Miller
E. E. Morgeneegg

Subgroup on Design Analysis (SC-D)

S. W. Tagart, Jr., *Chairman*
E. M. Lawrence, *Secretary*
R. S. Barsoum
H. M. Fishman
N. Gilbert

A. W. Lohmeier
S. Palusamy
E. R. Sliwinski
R. J. Thomas
Z. Zudans

Working Group on Shells (SG-DA) (SC-D)

H. M. Fishman, *Chairman*
R. S. Barsoum
C. Chen
A. Kalnins

R. W. Loomis
R. Raghavan
R. J. Thomas

Working Group on Inelastic Behavior (SG-DA) (SC-D)

S. Palusamy, *Chairman*
A. G. Eggers

H.-T. Huang
T. V. Narayanan

Working Group on Special Topics (SG-DA) (SC-D)

E. R. Sliwinski, *Chairman*
N. Gilbert
G. D. Gupta

E. M. Lawrence
A. W. Lohmeier

Subgroup on Elevated Temperature Design (SC-D)

R. I. Jetter, *Chairman*
A. W. Dalcher, *Secretary*
R. D. Campbell
J. B. Conway
J. M. Corum
J. M. Duke
E. P. Esztergar
M. T. Jakub
C. W. Lawton

C. F. Nash
W. J. O'Donnell
D. I. Roberts
F. A. Sebring
L. K. Severud
A. L. Snow
J. M. Tanzosh
B. C. Wei

Working Group on Creep Fatigue (SG-ETD) (SC-D)

R. D. Campbell, <i>Chairman</i>	P. J. Langford
C. R. Brinkman, <i>Secretary</i>	C. W. Lawton
J. B. Conway	R. K. Mattu
J. M. Duke	J. E. McConnelee
S. Guha-Majumdar	C. C. Schultz, Jr.
G. R. Halford	L. K. Severud
C. E. Jaske	W. Veljovich

Working Group on Creep Analysis (SG-ETD) (SC-D)

W. J. O'Donnell, <i>Chairman</i>	L. C. S. Nieh
J. M. Corum, <i>Secretary</i>	P. K. Patel
R. S. Barsoum	J. R. Ray
A. W. Dalcher	C. C. Schultz, Jr.
J. M. Duke	F. A. Sebring
D. S. Griffin	L. K. Severud
R. I. Jetter	R. A. Valentin

Working Group on Materials Behavior (SG-ETD) (SC-D)

D. I. Roberts, <i>Chairman</i>	R. I. Jetter
G. E. Korth, <i>Secretary</i>	R. A. Moen
C. R. Brinkman	G. V. Smith
J. B. Conway	J. M. Tanzosh

SUBCOMMITTEE ON BOILER AND PRESSURE VESSEL ACCREDITATION (SC-BPVA)

E. L. Kemmler, <i>Chairman</i>	Alternates
S. F. Harrison, <i>Vice Chairman</i>	S. C. Cyr
C. J. Gomez, <i>Secretary</i>	D. M. Fischer
D. W. Anacki	C. E. Ford
E. A. Becker	D. E. Lemon
R. A. Clemons	D. J. McDonald
D. R. Gallup	R. I. Mullican
J. C. Maxham	R. J. Sinisi
A. T. Slatt	S. M. Sullivan
J. A. Werhane	W. E. Vogler
J. M. Whelan	B. L. Whitley

SUBCOMMITTEE ON NUCLEAR ACCREDITATION (SC-NA)

E. J. Hemzy, <i>Chairman</i>	Alternates
M. N. Bressler, <i>Vice Chairman</i>	C. W. Allison
C. J. Gomez, <i>Secretary</i>	R. B. Bremmer
D. J. Carreira	F. R. Drahos
H. F. Dobel	R. E. Feigel
J. J. Duffy	J. Lang
W. S. Gibbons, Jr.	F. L. Moreadith
S. F. Harrison	U. Potapovs
W. G. Knecht	R. J. Tamminga
J. D. Lenardson	G. M. Tolson
H. A. Manning	A. M. Weiss
G. F. McDonald	B. L. Whitley
F. N. Moschini	
G. W. Reinmuth	
D. R. Young	

CONTENTS

A Detailed Contents Precedes Each Article

Foreword	v
Statements of Policy	vii
Personnel	ix
Organization of Section III	xxiii
The American Concrete Institute	xxv
Article NCA-1000 Scope of Section III	1
Article NCA-2000 Classification of Components	9
Article NCA-3000 Responsibilities and Duties	15
Article NCA-4000 Quality Assurance	43
Article NCA-5000 Authorized Inspection	49
Article NCA-8000 Certificates of Authorization, Nameplates, Code Symbol Stamping, and Data Reports	57
Article NCA-9000 Glossary	67

ORGANIZATION OF SECTION III

1. GENERAL

Section III consists of Division 1 and Division 2. Both Divisions are broken down into Subsections which are designated by capital letters preceded by the letter "N" for Division 1 and by the letter "C" for Division 2. The following nine books make up the two Divisions.

Subsection NCA — General Requirements for Division 1 and Division 2

Division 1

Subsection NB — Class 1 Components
Subsection NC — Class 2 Components
Subsection ND — Class 3 Components
Subsection NE — Class MC Components
Subsection NF — Component Supports
Subsection NG — Core Support Structures
Appendices

Division 2 — Code for Concrete Reactor Vessels and Containments

The Division 2 book includes Subsection CB—Concrete Reactor Vessels, Subsection CC—Concrete Containments, and Division 2 Appendices.

2. SUBSECTIONS

Subsections are divided into Articles, Subarticles, paragraphs, and, where necessary, subparagraphs and subsubparagraphs.

3. ARTICLES

Articles are designated by the applicable letters indicated above for the Subsections followed by Arabic numbers, such as NB-1000 or CB-2000. Where possible, Articles dealing with the same topics are given the same number in each Subsection in accordance with the following general scheme:

Article Number	Title
1000	Introduction or Scope
2000	Material
3000	Design
4000	Fabrication and Installation
5000	Examination
6000	Testing
7000	Overpressure Protection
8000	Nameplates, Stamping, and Reports

The numbering of Articles and the material contained in the Articles may not, however, be consecutive. Due to the fact that the complete outline may cover phases not applicable to a particular Subsection or Article, the rules have been prepared with some gaps in the numbering.

4. SUBARTICLES

Subarticles are numbered in units of 100, such as NB-1100 or CB-1200.

5. SUBSUBARTICLES

Subsubarticles are numbered in units of 10, such as NB-2130, and generally have no text. When a number such as NB-1110 is followed by text, it is considered a paragraph.

6. PARAGRAPHS

Paragraphs are numbered in units of 1, such as NB-2131 or CB-2132.

7. SUBPARAGRAPHS

Subparagraphs, when they are *major* subdivisions of a paragraph, are designated by adding a decimal followed by one or more digits to the paragraph number, such as NB-1111.1 or CB-1111.2. When they are *minor* subdivisions of a paragraph, subparagraphs may be designated by lowercase letters in parentheses, such as NB-1111(a) or CB-1111(b).

8. SUBSUBPARAGRAPHS

Subsubparagraphs are designated by adding lowercase letters in parentheses to the *major* subparagraph numbers, such as NB-1111.1(a) or CB-1111.1(b). When further subdivisions of *minor* subparagraphs are necessary, subsubparagraphs are designated by adding Arabic numerals in parentheses to the subparagraph designation, such as NB-1111(a)(1) or CB-1111(a)(2).

9. REFERENCES

References used within Section III generally fall into one of the following four categories:

A. References to Other Portions of Section III

When a reference is made to another Article, Subarticle, or paragraph, all numbers subsidiary to that reference shall be included. For example, reference to NB-3000 includes all material in Article NB-3000; reference to NB-3200 includes

all material in Subarticle NB-3200; reference to NB-3230 includes all paragraphs NB-3231 through NB-3236.

Wherever the term NX appears, it is intended to describe all the Subsections of Section III (NB, NC, ND, NE, NF, NG) where the referenced paragraph, Subarticle, or Article appears.

B. References to Other Sections

Other Sections referred to in Section III are:

Section II, Material Specifications. When a requirement for a material, or for the examination or testing of a material, is to be in accordance with a specification such as SA-105, SA-370, or SB-160, the reference is to material specifications in Section II. These references begin with the letter "S".

Section V, Nondestructive Examination. Section V references begin with the letter "T" and relate to the nondestructive examination of material or welds.

Section IX, Welding and Brazing Qualifications. Section IX references begin with the letter "Q" and relate to welding and brazing requirements.

Section XI, Inservice Inspection of Nuclear Power Plant Components. When a reference is made to inservice inspection, the rules of Section XI shall apply.

C. Reference to Specifications and Standards Other Than Published in Code Sections

(1) Specifications for examination methods and acceptance standards to be used in connection with them are published by the American Society for Testing and Materials. At the time of publication of Section III, some such specifications were not included in Section II of this Code. A reference to ASTM E 71-64 refers to the specification so designated by and published by ASTM, 1916 Race St., Philadelphia, Pa. 19103.

(2) Dimensional standards covering products such as valves, flanges, and fittings are approved by the American National Standards Institute¹ and published by the American

¹The American National Standards Institute (ANSI) was formerly known as the American Standards Association. Standards approved by the Association were designated by the prefix "ASA" followed by the number of the standard and the year of publication. More recently, the American National Standards Institute was known as the United States of America Standards Institute. Standards were designated by the prefix "USAS" followed by the number of the standard and the year of publication. While the letters of the prefix have changed with the name of the organization, the numbers of the standards have remained unchanged.

can Society of Mechanical Engineers. When a product is to conform to such a standard, for example ANSI B16.5, the standard is approved by the American National Standards Institute. The applicable year of issue is that suffixed to its numerical designation in Table NB-3132-1, for example ANSI B16.5-1977. ANSI-approved standards published by the American Society of Mechanical Engineers are available from ASME, 345 East 47th St., New York, N.Y. 10017. Other ANSI-approved standards are available from their publishers or the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

(3) Dimensional and other types of standards covering products such as valves, flanges, and fittings are also published by the Manufacturers Standardization Society of the Valve and Fittings Industry and are known as Standard Practices. When a product is required by these rules to conform to a Standard Practice, for example MSS SP-6, the Standard Practice referred to is published by the Manufacturers Standardization Society of the Valve and Fittings Industry, 1815 North Ft. Meyer Drive, Arlington, Va. 22209. The applicable year of issue of such a Standard Practice is that suffixed to its numerical designation in Table NB-3132-1, for example MSS SP-6-1963.

(4) Specifications for welding and brazing materials are published by the American Welding Society, 2501 Northwest 7th St., Miami, Fla. 33125. Specifications of this type are incorporated in Section II and are identified by the AWS designation with the prefix "SF", for example SFA-5.1.

(5) Standards applicable to the design and construction of tanks and flanges are published by the American Petroleum Institute and have designations such as API-620 and API-2000. When documents so designated are referred to in Section III, they are standards published by the American Petroleum Institute.

D. References to Appendices

Two types of Appendices are used in Section III and are designated Mandatory and Nonmandatory.

(1) Mandatory Appendices contain requirements which must be followed in construction: such references are designated by a Roman numeral followed by Arabic numerals. References to Table I-1.2 or II-1100, for example, relate to the Mandatory Appendices.

(2) Nonmandatory Appendices provide information or guidance for the use of Section III: such references are designated by a capital letter followed by Arabic numerals. A reference to D-1100, for example, relates to a Nonmandatory Appendix.

THE AMERICAN CONCRETE INSTITUTE

The American Concrete Institute was organized in 1905 to provide industry standards in the field of concrete usage. The organization, which was formed as a result of meetings begun during the Engineering Congress at the Louisiana Purchase Exposition in St. Louis in 1904, was initially entitled the National Association of Cement Users. In 1913, the name of the Society was changed to the American Concrete Institute to better fit the actual scope of its activities and aims, which are to further engineering education, scientific investigation, and scientific research by organizing the efforts of its members for a nonprofit, public service in gathering, correlating, and disseminating information for the improvement of the design, construction, manufacture, use, and maintenance of concrete products and structures.

The day-to-day operation of ACI is administered by an Executive Director, under general supervision of its 18-member Board of Direction, which assigns a part of its administrative duties to standing committees, the ACI Standards Board, and various technical committees.

ACI — TECHNICAL ACTIVITIES COMMITTEE

The Technical Activities Committee, which is appointed by the Board of Direction, is responsible for Institute technical publications, review of standards, the technical program at conventions, and continuing studies of technical committees, from which arise recommendations for the activities, and the formation or discharge of these groups. TAC members are selected by the ACI Board to represent ACI's varied interests.

ACI — STANDARDS BOARD

The Standards Board, also appointed by the Board of Direction, is responsible for matters of policy, procedure, and appeal pertaining to ACI Standards. All proposed new standards or revisions to existing standards, including minority reports from sponsoring technical committees, are forwarded to the Standards Board through the Technical Activities Committee. On release by the Standards Board, these are published, and after ratification by letter ballot of the ACI membership at large are then available for public use. The primary functions of the Standards Board are to verify that proper standardization procedures have been followed and to rule on matters of policy as related to standards.

ACI — TECHNICAL AND EDUCATIONAL COMMITTEES

Much of the important work of the American Concrete Institute is performed by technical committees that prepare committee reports and standards. Technical committees, composed of volunteer personnel, develop ACI recommendations in their respective fields. Their work, subject to review and approval by the Board of Direction through the Technical Activities Committee and the Standards Board, forms the basis for Institute Standards.

Educational committees, also composed of volunteer personnel, develop seminars, workshops, curriculum guides, and student manuals to further ACI's involvement in education. Their work, subject to review and approval by the ACI Educational Activities Committee, forms the basis for Institute manuals and training programs.

ARTICLE NCA-1000

NCA-1100	Scope.....	3
NCA-1110	Nature of These Rules and Components to Which They Are Applicable	3
NCA-1120	Definition of Nuclear Power System Items	3
NCA-1130	Limits of These Rules.....	3
NCA-1140	Use of Code Editions, Addenda, and Cases	4
NCA-1200	General Requirements for and Definitions of Items and Installation	5
NCA-1210	Components	5
NCA-1220	Materials.....	5
NCA-1221	Metallic Materials	5
NCA-1221.1	Metallic Material, ASTM Specification.....	5
NCA-1221.2	Welding Material, AWS Specification	5
NCA-1222	Nonmetallic Materials—Division 2	5
NCA-1222.1	Concrete and Grout	5
NCA-1222.2	Concrete and Grout Constituents.....	5
NCA-1230	Parts and Piping Subassemblies	5
NCA-1231	Parts	5
NCA-1232	Piping Subassemblies.....	6
NCA-1250	Component Supports.....	6
NCA-1260	Appurtenances	6
NCA-1270	Miscellaneous Items.....	6
NCA-1271	Control Rod Drive Housings.....	6
NCA-1272	Heater Elements.....	6
NCA-1273	Fluid Conditioner and Flow Control Devices Other Than Valves	6
NCA-1274	Penetration Assemblies	6
NCA-1275	Rupture Disk Devices	6
NCA-1280	Installation	6
NCA-1281	Activities and Requirements	6
NCA-1282	Component Support Installation	7
NCA-1283	Services	7

ARTICLE NCA-1000

SCOPE OF SECTION III

NCA-1100 SCOPE

NCA-1110 NATURE OF THESE RULES AND COMPONENTS TO WHICH THEY ARE APPLICABLE

The rules of this Section constitute requirements for the design, construction,^{1,2} stamping, and overpressure protection of nuclear power plant³ items⁴ such as vessels, concrete reactor vessels and concrete containments, storage tanks, piping systems, pumps, valves, core support structures, and component supports for use in, or containment of, portions of the nuclear power system of any power plant.⁵ A nuclear power system, as used in this Code, is that system which serves the purpose of producing and controlling an output of thermal energy from nuclear fuel and those associated systems essential to the functions and overall safety of the nuclear power system. The rules of this Section apply only to those items which are classified by the Owner as provided for in NCA-2110(d). All other equipment not so classed need not be constructed to this Section. The rules for inservice inspection of the items of the nuclear power system are covered in Section XI, and its rules may influence construction under this Section.

¹Construction, as used in Division 1, is an all-inclusive term comprising materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of items.

²Construction, as used in Division 2, includes all those operations required to build the component and its parts in accordance with the Design Drawings and Construction Specification which have been prepared by the Designer.

³A nuclear power plant consists of one or more nuclear power systems and containment systems as well as other systems not covered by the rules of this Section.

⁴Items as used in this Section are products constructed under a Certificate of Authorization (NCA-3120) and material (NCA-1220).

⁵Specifically excluded from consideration in this Section are tubes or other forms of sheathing used only for cladding nuclear fuel or neutron control material.

NCA-1120 DEFINITION OF NUCLEAR POWER SYSTEM ITEMS

(a) Nuclear power system items for which rules are specified by this Section are those items which are designed to provide a pressure containing barrier or are a pressure retaining member in the system and those designed as core support structures and component supports.

(b) Containment systems for which rules are specified by this Section are those items which form structures that enclose nuclear power systems or that may be connected to other containment items and which are designed to provide a pressure containing barrier for the primary purpose of containing, within leakage limits, or of channeling, for containment or for controlled disposal, radioactive or hazardous effluents released from the system. Containment structures may be constructed either to Subsection NE or Subsection CC of this Section.

(c) Concrete reactor vessels for which rules are specified by this Section are composite steel and concrete components which are to function as a component of the principal pressure containing barriers for the nuclear fuel's primary heat extraction fluid (primary coolant).

(d) Concrete containments are composite steel and concrete assemblies that are designed as an integral part of the containment's pressure retaining barrier which retain or control the release of radioactive or hazardous effluents released from the nuclear power plant equipment which the containment encloses.

NCA-1130 LIMITS OF THESE RULES

(a) The rules of this Section provide requirements for new construction and include consideration of mechanical and thermal stresses due to cyclic operation. They do not cover deterioration which may occur in service as a result of radiation effects, corrosion, erosion, or instability of the material. These