

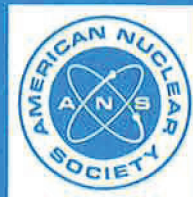
American Nuclear Society

cooldown criteria for light water reactors

WITHDRAWN

an American National Standard

No longer being maintained as an American National Standard. This standard may contain outdated material or may have been superseded by another standard. Please contact the ANS Standards Administrator for details.



published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA

**American National Standard
Cooldown Criteria for Light
Water Reactors**

Secretariat
American Nuclear Society

Prepared by the
**American Nuclear Society
Standards Committee
Working Group ANS-58.11**

Published by the
**American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA**

Approved May 10, 1983
by the
American National Standards Institute, Inc.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be reviewed or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of this standard may receive current information, including interpretation, on all standards published by the American Nuclear Society by calling or writing to the Society.

Published by

American Nuclear Society
555 North Kensington Avenue, La Grange Park, Illinois 60525 USA

Price: \$12.00

Copyright © by American Nuclear Society.

Any part of this standard may be quoted. Credit lines should read "Extracted from American National Standard ANSI/ANS-58.11-1983 with permission of the publisher, the American Nuclear Society." Reproduction prohibited under copyright convention unless written permission is granted by the American Nuclear Society.

Printed in the United States of America

Foreword

(This Foreword is not a part of American National Standard Cooldown Criteria for Light Water Reactors, ANSI/ANS-58.11-1983.)

Background

This standard provides guidance to the plant designer regarding the means to achieve a plant cooldown from normal or post-accident conditions. However it may not be prudent to deliberately impose reactivity, temperature and pressure transients on the plant, by proceeding to the cold shutdown condition, following every transient which requires a shutdown of the reactor.

Development of Standard

Subcommittees ANS-51, "Pressurized Water Reactor (PWR) Criteria" and ANS-52, "Boiling Water Reactor (BWR) Criteria" provided workers from the PWR and BWR industries to serve on working group ANS-58.11 to develop this standard. The members of the working group which prepared this document were:

R. W. Fleming, Chairman, *Westinghouse Electric Corporation*
V. M. Callaghan, *Combustion Engineering*
C. Carossino, *Southern California Edison*
R. Dewberry, *Southern Company Services*

C. Graves, *Nuclear Regulatory Commission*
W. G. Poulson, *Westinghouse Electric Corporation*
E. Swanson, *Babcock & Wilcox*
G. Wrobel, *Rochester Gas & Electric*

Corresponding Members:

H. L. Massin, *Commonwealth Edison Company*
A. N. Tschaeche, *General Electric*

R. A. Hill, *General Electric*

Liaison representatives from the Institute of Electrical and Electronics Engineers, Inc. (IEEE) SC-6:

P. Duggan, *Consolidated Edison Company*

E. Steudel, *Bechtel Corporation*

Review by Nuppsco

The standard was issued for review by the American Nuclear Society's Nuclear Power Plant Standards Committee (NUPPSCO) as Draft 2 of August 1980.

All comments received, particularly those leading to a negative ballot, were reviewed by the working group and this version of the standard was prepared incorporating what was felt to be the substance of the comments.

The major issue addressed in many of the comments involved Paragraph 2.5.4 of Draft 2 which attempted to provide guidance to the designer for plant conditions beyond the design basis. The original Paragraph 2.5.4 read as follows:

"Provisions for extended shutdown operations in response to abnormal initiating events not specifically identified should be made. This would include flanged tie-in points, spool pieces, etc. located in accessible areas, to allow onsite addition of backup systems if required due to unexpected problems with the normal plant systems and equipment."

The issue of extending the cooldown criteria to multiple equipment failures and human operator errors beyond the design basis accident scenarios discussed in a typical Final Safety Analysis Report was discussed at several regular meetings of NUPPSCO. An ad hoc committee also studied the issue and was not able to give

positive guidance to the ANS-58.11 working group. Therefore, at the regular NUPPSCO meeting on March 25, 1981, it was decided that Paragraph 2.5.4 and its subject matter should be removed from the ANS-58.11 standard and that the subject of plant conditions beyond the normal design basis should be addressed in these American National Standards:

Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, ANSI/ANS-51.1-1983, and

Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants, ANSI/ANS-52.1-1983.

After the new material is incorporated in ANS-51.1 and ANS-52.1, the cooldown standard, ANS-58.11-1983, will be revised, if required, to address the new conditions.

At the conclusion of the comment resolution period, three members of NUPPSCO chose to maintain their negative ballots based on the following three concerns:

Concern 1: "The equipment required to make the transition from hot standby to cold shutdown need not be nuclear safety related"; in particular, the steam generator steam relief system and letdown path (except as a pressure boundary).

Concern 2: "I do not believe that cold shutdown can be achieved in a reasonable amount of time following a loss of coolant accident (LOCA)"; in particular the cooldown goal of 36 hours stated in 2.7.2 is unachievable for post accident conditions.

Concern 3: "The reactivity control function (Paragraph 3.1) is of utmost importance. Therefore, equipment providing that function needs to be as resistant to common-mode failures as practical. Thus, there needs to be a requirement that systems providing reactivity control shall be comprised of at least one system that is independent and diverse from another. If this is accomplished by a third system that is independent and diverse to two redundant safety-related systems, this third system need not be safety-related."

During the preparation of the cooldown standard, the members of the working group discussed each of the above concerns at length and concluded that the positions taken in the standard are correct and should remain as written.

The American Nuclear Society's Nuclear Power Plant Standards Committee (NUPPSCO) had the following membership at the time of its approval of this standard.

L. J. Cooper, Chairman
M. D. Weber, Secretary

Name of Representative	Organization Represented
G. A. Arlotto	U.S. Nuclear Regulatory Commission
R. G. Benham	General Atomic Company (for the Institute of Electrical and Electronics Engineers, Inc.)
R. E. Allen (Alt.)	United Engineers & Constructors, Inc. (for the Institute of Electrical and Electronics Engineers, Inc.)
R. V. Bettinger	Pacific Gas and Electric Company
P. Bradbury	Westinghouse Advanced Reactor Division
D. A. Campbell	Westinghouse Electric Corporation
C. O. Coffey	Pacific Gas & Electric Company
L. J. Cooper	Nebraska Public Power District (for the American Nuclear Society)
W. H. D'Ardenne	General Electric Company
C. J. Gill	Bechtel Power Corporation
H. J. Green	Tennessee Valley Authority
A. R. Kasper	Combustion Engineering, Inc.
R. W. Keaten	GPU Services Corporation
J. W. Lentsch	Portland General Electric Company
J. F. Mallay	NUTECH Engineers*
A. T. Molin	United Engineers and Constructors, Inc.
J. H. Noble	Chas. T. Main, Inc.
E. P. O'Donnell	Ebasco Services, Inc. (for the Atomic Industrial Forum)
T. J. Pashos	Individual
P. T. Reichert	Catalytic, Inc.
M. E. Remley	Rockwell International
J. Stacey	Yankee Atomic Electric Company
S. L. Stamm	Stone & Webster Engineering Corporation
L. J. Stanek	Babcock & Wilcox Company
J. D. Stevenson	Structural Mechanics Associates (for the American Society of Civil Engineers)
G. Wagner	Commonwealth Edison Company
G. L. Wessman	Torrey Pines Technology
J. E. Windhorst	Southern Company Services, Inc. (for the American Society of Mechanical Engineers)
E. R. Wiot	NUS Corporation

*Formerly with Babcock & Wilcox Company

Contents	Section	Page
1.	Scope	1
2.	General Criteria	1
	2.1 System Design Bases	1
	2.2 Postulated Plant Conditions	1
	2.3 Functions for Plant Cooldown	1
	2.4 Equipment Design Criteria	1
	2.5 System Design Criteria	1
	2.6 Operator Action Criteria	2
	2.7 Performance Criteria	2
3.	Reactivity Control Criteria	2
	3.1 Reactivity Control Bases	2
	3.2 Boron Storage Criteria	3
	3.3 Reactor Coolant Mixing Criteria — PWR	3
4.	Heat Removal Criteria	3
	4.1 General Criteria	3
	4.2 Special Criteria	3
5.	Reactor Coolant System (RCS) Integrity	3
	5.1 RCS Pressure Control — PWR	3
	5.2 RCS Pressure Control — BWR	5
	5.3 Reactor Coolant Inventory Control — PWR	5
	5.4 Reactor Coolant Inventory Control — BWR	6
6.	References	6
	Appendix Bibliography	7