American Nuclear Society

pwr and bwr containment spray system design criteria

an American National Standard

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

ANSI/ANS-56.5-1979

AMERICAN NUCLEAR SOCIETY

555 North Kensington Avenue
La Grange Park, Illinois
60526-5592 USA

Tel: 708/ 352-6611
E-Mail: NUCLEUS@ans.org
http://www.ans.org
Fax: 708/ 352-0499

It is intended that this statement be placed on the list of

Historical American National Standards

published by

The American Nuclear Society

Users of these documents should be aware that these standards either have been superceded, or they have not been maintained in accordance with ANSI/ANS requirements. They can be made available to users in printed format or electrostatic copies and will be priced accordingly.

ERRATUM

ANSI/ANS-56.5-1979

Equation 8.3.6-2, page 21

$$\bar{d}_{IR} = \left[\frac{\sum_{i=1}^{n} f(d_i)\ d_i^{-2.2}}{\sum_{i=1}^{n} f(d_i)} \right]^{\frac{-1}{2.2}} \qquad \text{(Eq. 8.3.6-2)}$$

should have the negative signs on both of the exponents deleted. It should read

$$\bar{d}_{IR} = \left[\frac{\sum_{i=1}^{n} f(d_i)\ d_i^{\,2.2}}{\sum_{i=1}^{n} f(d_i)} \right]^{\frac{1}{2.2}} \qquad \text{(Eq. 8.3.6-2)}$$

ANSI/ANS-56.5-1979

American National Standard for PWR and BWR Containment Spray System Design Criteria

Secretariat
American Nuclear Society

Prepared by the
American Nuclear Society
Standards Committee
Working Group ANS-56.5

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

Approved November 7, 1979
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CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time.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: $32.00

Printed in the United States of America

Foreword

(This Foreword is not a part of American National Standard for PWR and BWR Containment Spray System Design Criteria, ANSI/ANS-56.5-1979.)

The first meeting of the working group was held in the spring of 1975. During the preparation of the first outlines, the working group was confronted with a basic problem of how to write a design criteria standard that would apply to both PWR and BWR Containment Spray Systems. The working group addressed this problem by discussing all functions of the Containment Spray System and then prefacing appropriate sections by limiting statements, such as: "for iodine removal purposes," or "for pressure suppression purposes." It was felt that such an approach would allow the designer to select the appropriate portions of the standard.

Another fundamental goal was the attainment of a standard that would provide clear and detailed guidance to the designer. Thus, the document attempts to present all necessary design considerations. When the state-of-the-art technology indicates a preferred method, the standard will suggest that method. Although it is desirable to give the designer flexibility, it was the goal of the group to draft a standard that would encourage standard high quality designs. As a consequence, most of the criteria are requirements. When several equivalent approaches exist, flexibility is preserved. Backup information for fission product removal calculations is included as an Appendix to the standard.

This standard employs a technique using a discrimination device called "boxing." This technique indicates those statements which are nuclear safety related. The term "nuclear safety" includes those requirements that are felt by the writing group to arise from official and implied NRC policies (including regulations, regulatory guides, branch positions, the Standard Review Plan, and past practice on applications) *as well as* other requirements the group believes are related to nuclear safety. Non-nuclear safety related requirements include the following types of needs as they exclusively apply to areas not considered to be nuclear safety related:conventional safety, equipment reliability, plant availability, good engineering practice, and contractual (commercial) requirements.

During the preparation of this standard, the membership of ANS-56.5 was as follows:

D. C. Hintz, Chairman, *Wisconsin Public Service Corporation*
N. Weber, Secretary, *Sargent & Lundy*
J. A. Elsner, *NEL-PIA/MAELU*
F. Fanello, *Fluor Pioneer, Inc.*
P. H. Hepner, *Combustion Engineering, Inc.*
S. J. Hynek, *Stone & Webster Engineering Corp.*
L. P. King, *Babcock & Wilcox Company*
W. F. Pasedag, *U.S. Nuclear Regulatory Commission*
D. A. Pullen, *General Electric Company*
C. R. Broadus, *General Electric Company*
R. J. Schmidt, *Northeast Utilities Service Company*
E. V. Somers III, *Westinghouse Electric Corporation*

The American Nuclear Society's Nuclear Power Plant Standards Committee (NUPPSCO) had the following membership at the time it balloted this standard in March 1979.

J. F. Mallay, Chairman
M. D. Weber, Secretary

Organization Represented	*Name of Representative*
U.S. Nuclear Regulatory Commission	G. A. Arlotto
Catalytic, Inc.	R. E. Basso
Institute of Electrical and Electronics Engineers (General Atomic Company)	R. G. Benham
Institute of Electrical and Electronics Engineers (Knolls Atomic Laboratory)	O. W. Bilharz, Jr. (Alt).
Pacific Gas and Electric Company	R. V. Bettinger
Westinghouse Advanced Reactor Division	P. Bradbury
Westinghouse Electric Corporation	D. A. Campbell
Kaiser Engineers	C. O. Coffer
Nebraska Public Power District	L. J. Cooper
General Electric Company	W. H. D'Ardenne
U.S. Department of Energy	F. X. Gavigan
Bechtel Power Corporation	C. J. Gill
Tennessee Valley Authority	H. J. Green
U.S. Environmental Protection Agency	J. M. Gruhlke
Combustion Engineering, Inc.	A. R. Kasper
GPU Services Corporation	R. W. Keaten
Fluor Power Services	D. M. Leppke
American Nuclear Society (Babcock & Wilcox Company)	J. F. Mallay
United Engineers and Constructors	A. T. Molin
Individual Member	J. H. Noble
Nuclear Services Corporation	T. J. Pashos
Tennessee Valley Authority	D. R. Patterson
Atomics International	M. E. Remley
Atomic Industrial Forum (Ebasco Services, Inc.)	E. P. O'Donnell
Yankee Atomic Electric Company	J. W. Stacey
Stone & Webster Engineering Corporation	S. L. Stamm
Commonwealth Edison Company	G. Wagner
Sargent & Lundy Engineers	J. E. Ward
General Atomic Company	G. L. Wessman
American Society of Mechanical Engineers (Southern Company Services)	J. E. Windhorst
NUS Corporation	E. R. Wiot

Contents

Figures

PWR and BWR Containment Spray System Design Criteria

1. Scope

This standard provides the design, performance, testing, maintenance, and instrumentation and control requirements for the containment spray system for boiling water and pressurized water reactor stationary electric generating plants.

The containment spray system, consisting of a spray subsystem and an additive subsystem, serves to mitigate the consequences of a loss of coolant accident, a PWR feedwater line or a PWR steam line break, by injecting a water spray into the containment atmosphere. The containment spray system may be used to aid safety by performing one or more of the following functions:

(1) Containment Post-Accident Pressure Suppression

(2) Containment Post-Accident Heat Removal

(3) Containment Atmosphere Post-Accident Fission Product Removal

(4) Post-Accident Mixing of Containment Atmosphere

(5) Post-Accident Containment Sump Chemistry Control.

2. Purpose

The purpose of this standard is to define the design requirements for a water spray system within LWR containment that provides the necessary coolant to reduce the pressure, remove heat and fission products, provide sump chemistry control and post-accident atmosphere mixing following a loss-of-coolant accident.

3. Definitions

acceptable. The word "acceptable" is used when a system or component has been demonstrated to meet its design and performance criteria by test or analysis.

active component. A mechanical component in which physical movement must occur upon demand in order to perform the component's intended function.

active failure. A malfunction, excluding passive failures, of a component which relies on mechanical movement to complete its intended function upon demand.

Examples of active failures include the failure of a valve or check valve to move to its correct position or the failure of a pump, fan, or diesel generator to start.

Spurious action of a powered component originating within its actuation or control system shall be regarded as an active failure unless specific design features or operating restrictions preclude such spurious action. An example is the unintended energizing of a powered valve to open or close. Additional guidance is provided in American National Standard Single Failure Criteria for PWR Fluid Systems, N658-1976 (ANS-51.7). [1][1]

(This concept of active failure and passive failure currently does not apply to electrical components.)

additive. In the context of containment spray systems, any substance added to the spray water to adjust pH or enhance fission product removal.

additive subsystem. That portion of the containment spray system which is specifically designed to place additive(s) into the spray water during spray operation.

containment. See primary reactor containment.

[1]Numbers in brackets refer to corresponding numbers of Section 9, References.