American Nuclear Society

subcompartment pressure and temperature transient analysis in light water reactors

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American National Standard for Subcompartment Pressure and Temperature Transient Analysis in Light Water Reactors

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American Nuclear Society

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Foreword

(This Foreword is not a part of American National Standard for Subcompartment Pressure and Temperature Transient Analysis in Light Water Reactors, ANSI/ANS-56.10-1982.)

The ANS-56.10 Working Group held its first meeting in August 1980. During the development of the first drafts of the standard, the working group was faced with the problem of how to write a standard dealing with analytical treatment of physical phenomena. There is a tendency to produce either a textbook or a document that has virtually no technical content. The group decided on the goal of providing guidance for the analyst in the text of the standard and insight in the appendices.

There was the continual search for the right amount and type of information to include within the text of the standard. Several assumptions were made by the group to this end. First, it was assumed that the analyst using this standard already had computer codes at his disposal and, therefore, the governing equations were not included in the standard. Second, guidance was interpreted to mean necessary or required information for the performance of the desired analysis by either hand or computer methods. A method for a hand calculation of the short-term mass and energy release determination is presented within the standard. Third, the working group endeavored to keep the end use of the analysis in mind while writing the prescription for the various analyses and their associated assumptions covered in the standard.

This standard will aid the analyst in his execution of an acceptable analysis for the determination of pressure and temperature histories resulting from high-energy line breaks and other events.

During the preparation of this standard, the ANS-56.10 membership was as follows:

N. Weber, Chairman, *Sargent & Lundy*
C. G. Robertson, *Secretary, Houston Lighting & Power**
R. M. Glasgow, *Southern Company Services, Inc.*
D. F. Mitchell, *Duke Power Company*
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*Formerly with Stone and Webster Engineering Corporation
**Formerly with General Electric
***Formerly with EDS Nuclear

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

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G. L. Wessman	*Torrey Pines Technology*
J. E. Windhorst	*Individual*

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Subcompartment Pressure and Temperature Transient Analysis in Light Water Reactors

1. Introduction and Scope

1.1 Introduction. The design and licensing of nuclear power plants requires that subcompartments and components, both inside and outside of primary reactor containment, be analyzed for pressure, temperature, and flooding effects. The analyses include short-term pressure and temperature transients to which the subcompartments will be exposed as a result of the postulated line breaks and also include determination of long-term pressure and temperature transients resulting from both normal and abnormal occurrences. This standard considers subcompartments located both inside and outside of the primary reactor containment.

1.2 Purpose. The purpose of this standard is to provide methodology and criteria necessary to accomplish the pressure and temperature transient analyses required for subcompartment design and equipment qualification.

1.3 Scope. This standard provides criteria for the analysis of subcompartment pressure, temperature, and flooding transients resulting from high- or moderate-energy line breaks and other events both inside and outside light water reactor primary containments. Criteria are provided for the determination of mass and energy release rates and for the formulation of input parameters to assure a conservative subcompartment or building design basis. Attention is given to the intended use of the transient data. Interfaces with active and passive systems such as valves and structural heat sinks are treated. The qualification of equipment and design of their supports is also addressed through treatment of long-term pressure and temperature transients and also asymmetric pressure loading and its effects.

1.4 Limitations and Interfaces. This standard does not consider jet forces and associated effects resulting from the line breaks, pipe hanger design, or break location determination. These items are covered in American National Standard Design Basis for Protection of Light Water Reactor Nuclear Power Plants Against the Effects of a Postulated Pipe Rupture, ANSI/ANS-58.2-1980 [1].[1] This standard interfaces with ANSI/ANS-58.2-1980 [1] and other standards currently in draft form[2,3]. The interface with the latter document[3] is accomplished by providing criteria for analyses that determine the pressure and temperature histories that will be compared with those used for equipment specification and qualification.

2. Definitions

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

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

Spurious operation of a powered component due to a failure originating within its automatic actuation or control systems shall be regarded as an active failure unless specific features or operating restrictions (such as "racking out" a breaker to a motor-operated valve) are incorporated to prevent such spurious operation. An example of spurious operation is the unintended energizing of a powered valve to open or close.

conservative. The application of uncertainties in the values of analysis input parameters,

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[1] Numbers in brackets refer to corresponding numbers in Section 7, References.

[2] Proposed American National Standard Pressure and Temperature Transient Analysis for Light Water Reactor Containments, ANS-56.4; assigned correspondent: N. Weber, Sargent & Lundy, 55 E. Monroe St., Chicago, Ill. 60603.

[3] Proposed American National Standard Environmental Envelopes for Design of Light Water Reactor Nuclear Power Plants, ANS-56.9; assigned correspondent: B. Skonberg, 1881 Mitchell Ave., Suite 129, Tustin, Calif. 92680.