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An American National Standard

Standard Guide for Development of Fire-Risk-Assessment Standards[1]

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1. Scope

1.1 This guide covers the development of fire-risk-assessment standards.

1.2 This guide is directed toward development of standards that will provide procedures for assessing fire risks harmful to people, property, or the environment.

2. Referenced Documents

2.1 *ASTM Standards:*

E 176 Terminology of Fire Standards[2]

E 603 Guide for Room Fire Experiments[2]

E 1546 Guide for Development of Fire-Hazard-Assessment Standards[2]

2.2 *Other Documents:*

SFPE Engineering Guide to Performance-Based Fire Protection, Society of Fire Protection Engineers and NFPA, Quincy, MA, 2000[3]

3. Terminology

3.1 *Definitions*—See Terminology E 176.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *fire-test-response-characteristic index, n*—a single quantitative measure that combines two or more fire-test-response characteristics for a material, product, or assembly, all developed under test conditions compatible with a common fire scenario, addressing collectively the corresponding threat. See also *fire-test-response-characteristic profile, fire hazard, fire risk, fire-test-response characteristic*.

3.2.2 *fire-test-response-characteristic profile, n*—array of fire-test-response characteristics for a material, product, or assembly, all developed under test conditions compatible with a common fire scenario, addressing collectively the corresponding threat. See also *fire hazard, fire risk, fire-test-response characteristic*.

4. Significance and Use

4.1 This guide is intended for use by those undertaking the development of fire-risk-assessment standards. Such standards are expected to be useful to manufacturers, architects, specification writers, and authorities having jurisdiction.

4.2 As a guide, this document provides information on an approach to the development of a fire-risk-assessment standard; fixed procedures are not established. Limitations of data, available tests and models, and scientific knowledge can constitute significant constraints on the fire-risk-assessment procedure and associated standard.

4.3 While the focus of this guide is on developing fire-risk-assessment standards for products, the general concepts presented also can be applied to processes, activities, occupancies, and buildings.

5. Key Elements

5.1 This guide uses as its key elements the following:

5.1.1 The purpose of a fire-risk-assessment standard is to provide a standardized procedure for assembling a compilation of information relevant to the fire risk of a product under specific conditions of use.

5.1.2 The information assembled shall be relevant to the purpose of assessing the fire risk of the specific designated product within the range of all relevant fire scenarios.

5.1.3 The information assembled shall be explicit and quantitative. It shall provide a sufficiently thorough examination of the product's fire risk under the conditions defined by the scope of the specific standard so as to permit valid choices and decisions with respect to the fire risk of that product.

5.1.4 A persuasive scientific case must be made in the documentation of a specific fire-risk-assessment standard that the procedures, data, and risk measures specified by the standard will address questions about a product's fire risk with sufficient accuracy and validity that a more thorough assessment procedure would not materially alter any decisions that are to be made based on the standard. If such a case cannot be made for all products to be addressed, then the risk assessment shall specify those conditions under which a more thorough fire-risk-assessment procedure is to be used.

5.1.5 The absence of a data source, test method, or calculation procedure of sufficient scope and proven validity to support the needs of a particular fire-risk-assessment procedure does not, by itself, provide a sufficient justification for the use of a data source, test method, or calculation procedure of lesser scope or unproven validity. It is recognized that fire-risk assessments of such products may need to be performed in any

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[2] *Annual Book of ASTM Standards*, Vol 04.07.

[3] Available from NFPA, 1 Batterymarch Park, Quincy, MA 02269–9101.

event, using relevant nonstandardized procedures. When such nonstandardized or unvalidated procedures are used, the details shall be included to such an extent that the procedures become standardized only for use within the specified fire-risk-assessment procedure through final publication of the fire-risk-assessment standard document.

5.1.6 Among the possible significant outcomes of a fire-risk assessment are a revelation that a product produces either an increase, no increase, or a decrease in fire risk on some or all risk measures and for all or some of the scenarios specified by the standard relative to another product or relative to baseline risk values for those measures and scenarios. These baseline values may or may not be derived from fire-risk assessment of products already in use. However, when the product is proposed for an existing use, the appropriate baseline for comparison is existing products having the same use. For example, if a product's risk is uniformly rated greater than the reference values on all comparisons specified by the standard, then the overall fire-risk assessment of the product will be greater than the fire risk of the baseline (or product in use).

5.1.7 If the assessment shows that the product is not uniformly rated higher than, equivalent to, or less than the other product(s) or the baseline for all risk measures, and reflecting all scenarios specified by the standard, then the implications of the fire risk assessment for product evaluation will not be clear without the development of appropriate decision rules. Such rules would determine the overall risk, giving appropriate weighting to each risk measure.

6. Relationship Between Fire Hazard and Fire Risk

6.1 It is important to differentiate between *fire hazard* and *fire risk*. The relationship is as follows:

6.1.1 A fire-hazard measure addresses the expected performance of a product for a particular fire scenario, including designated conditions of use. A fire-risk measure incorporates fire-hazard measures but also incorporates the probability of occurrence of each fire scenario and addresses all relevant fire scenarios.

6.1.2 Because the number of distinguishable relevant fire scenarios in any fire-risk assessment is usually unmanageably large, it will normally be necessary for fire scenarios to be grouped into classes for purposes of analysis. This may make the fire-risk assessment less product-specific or less specific to specific conditions of use than would be true of a fire-hazard assessment.

6.1.3 Some existing fire-risk-assessment models and calculation procedures define fire risk as the sum over all fire scenario classes of the probability-weighted fire hazard for that fire scenario class. In such an approach:

6.1.3.1 The fire scenarios in each fire scenario class shall be very similar with respect to those characteristics that determine fire hazard.

6.1.3.2 Each fire scenario class will have a probability (P_i) that represents the likelihood of a fire corresponding to a scenario in that class.

6.1.3.3 For each fire scenario class, a specific fire scenario shall be chosen as representative of the class, so that the fire hazard for that specific fire scenario can be used as a valid estimate of H_i, the fire hazard of the fire scenario class. This is defined as the probability-weighted mean fire hazard for all the specific fire scenarios in the fire scenario class, a quantity that cannot be directly calculated.

6.1.3.4 If this structure is adopted, then the relationship between fire risk measure and fire hazard measure is given by the following formula:

$$Risk = \Sigma_i (P_i \times H_i) \quad (1)$$

where:

H_i = hazard for representative scenario of scenario class i, $i = 1, ..., n$ and

P_i = probability of scenario class i, $i = 1, ..., n$.

6.1.4 For a fire-risk-assessment standard, this formula shows that a fire-risk-assessment procedure may be constructed from a fire-hazard-assessment procedure, a valid structure of fire scenario class and representative fire scenarios by class, and valid sources for fire scenario class probability data.

7. Fire Risk-Assessment Standards

7.1 Fire-risk-assessment standards shall conform in style and content to the *ASTM Form and Style Manual*[4].

7.2 Fire-risk-assessment standards shall include sections entitled: Scope, Significance and Use, Terminology, and Procedure. The sections shall be numbered and arranged in that order.

7.2.1 *Scope*—The statement in the Scope should clearly state:

7.2.1.1 The product or class of products of interest,

7.2.1.2 The fire scenario(s) included in the standard,

7.2.1.3 The assumptions used in the standard,

7.2.1.4 The structure of the fire-risk-assessment procedure, including test methods, models, other calculation procedures, data sources, fire hazard measures, fire risk measures, and any other evaluation criteria or procedures used, and

7.2.1.5 Any limitations on the application of the standard, such as the manner, form, or orientation in which the product is incorporated within an assembly, geometric restrictions essential to use of the product, the quantity of product in use, the end use of the product, and the type of occupancy to which the standard is applicable.

7.2.2 *Significance and Use*:

7.2.2.1 The major uses and any limitations of the standard fire-risk-assessment procedure shall be clearly described, including an explicit description of the extent to which the included fire scenarios, in 7.2.1.2, constitute all the relevant fire scenarios for the product (class) and occupancy type addressed by the standard.

7.2.2.2 The significance of the assessment to users shall be clearly stated.

7.2.3 *Terminology*—Terms unique to the fire-risk-assessment standard shall be clearly defined. Standard terms as defined in Terminology E 176 shall be used.

7.2.4 *Procedure*:

7.2.4.1 This section shall include detailed descriptions of the fire-risk-assessment procedure and its component parts,

[4] Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.