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Guidance for assessing the validity of physical fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment —

Part 2:
Evaluation of individual physical fire models

Lignes directrices pour évaluer la validité des modèles de feu physiques pour l'obtention de données sur les effluents du feu en vue de l'évaluation des risques et dangers —

Partie 2: Évaluation des différents modèles de feu physiques

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 16312-2 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 3, *Fire threat to people and environment*.

ISO 16312 consists of the following parts, under the general title *Guidance for assessing the validity of physical fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment*:

- *Part 1: Criteria*
- *Part 2: Evaluation of individual physical fire models* [Technical Report]

Introduction

Providing the desired degree of life safety for an occupancy increasingly involves an explicit fire hazard or risk assessment. This assessment includes such components as information on the room/building properties, the nature of the occupancy, the nature of the occupants, the types of potential fires, the outcomes to be avoided, etc.

This type of determination also requires information on the potential for harm to people due to the effluent produced in the fire. Because of the prohibitive cost of real-scale product testing under the wide range of fire conditions, most estimates of the potential harm from the fire effluent depend on data generated from a physical fire model, a reduced-scale test apparatus and procedure for its use.

The role of a physical fire model for generating accurate toxic effluent composition is to simulate the essential features of the complex thermal and reactive chemical environment in full-scale fires. These environments vary with the physical characteristics of the fire scenario and with time during the course of the fire, and close representation of some phenomena occurring in full-scale fires can be difficult or even not possible at the small scale. The accuracy of the physical fire model, then, depends on two features:

a) degree to which the combustion conditions in the bench-scale apparatus mirror those in the fire stage being simulated;

b) degree to which the yields of the important combustion products obtained from burning of the commercial product at full scale are matched by the yields from burning specimens of the product in the small-scale model. This measure is generally performed for a small set of products, and the derived accuracy is then presumed to extend to other test subjects. At least one methodology for effecting this comparison has been developed.[1]

This part of ISO 16312 provides a set of technical criteria for evaluating physical fire models used to obtain composition and toxic potency data on the effluent from products and materials under fire conditions relevant to life safety. This Technical Report comprises the application by experts of these criteria to currently used test methods that are used for generating data on smoke effluent from burning materials and commercial products.

There are 12 physical fire models discussed in this part of ISO 16312. Additional apparatus can be added as they are developed or adapted with the intent of generating information regarding the toxic potency of smoke.

For the 12 models in this part of ISO 16312, the first five are closed systems. In these, no external air is introduced and the combustion (or pyrolysis) products remain within the apparatus except for the fraction removed for chemical analysis. The second seven are open apparatus, with air continuously flowing past the combusting sample and exiting the apparatus, along with the combustion products.

To make use of this part of ISO 16312, it is necessary for the user to have present a copy of ISO 16312-1, which contains much of the context and definitions for the present document. It is also necessary to make reference to ISO 19701[33], ISO 19702[34], ISO 19703, ISO 13344[31], and ISO 13571[32] for discussions of analytical methods, bioassay procedures, and prediction of the toxic effects of fire effluents.

Guidance for assessing the validity of physical fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment —

Part 2:
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1 Scope

This part of ISO 16312 assesses the utility of physical fire models that have been standardized, are commonly used and/or are cited in national or international standards, for generating fire effluent toxicity data of known accuracy. It does so using the criteria established in ISO 16312-1 and the guidelines established in ISO 19706. The aspects of the models that are considered are the intended application of the model, the combustion principles it manifests, the fire stage(s) that the model attempts to replicate, the types of data generated, the nature and appropriateness of the combustion conditions to which test specimens are exposed and the degree of validity established for the model.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13943, *Fire safety — Vocabulary*

ISO 16312-1, *Guidelines for assessing the validity of physical fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment — Part 1: Criteria*

ISO 19703, *Generation and analysis of toxic gases in fire — Calculation of species yields, equivalence ratios and combustion efficiency in experimental fires*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and in ISO 19703 apply.

4 General principles

4.1 Physical fire model

A physical fire model is characterized by the requirements placed on the form of the test specimen, the operational combustion conditions and the capability of analysing the products of combustion.